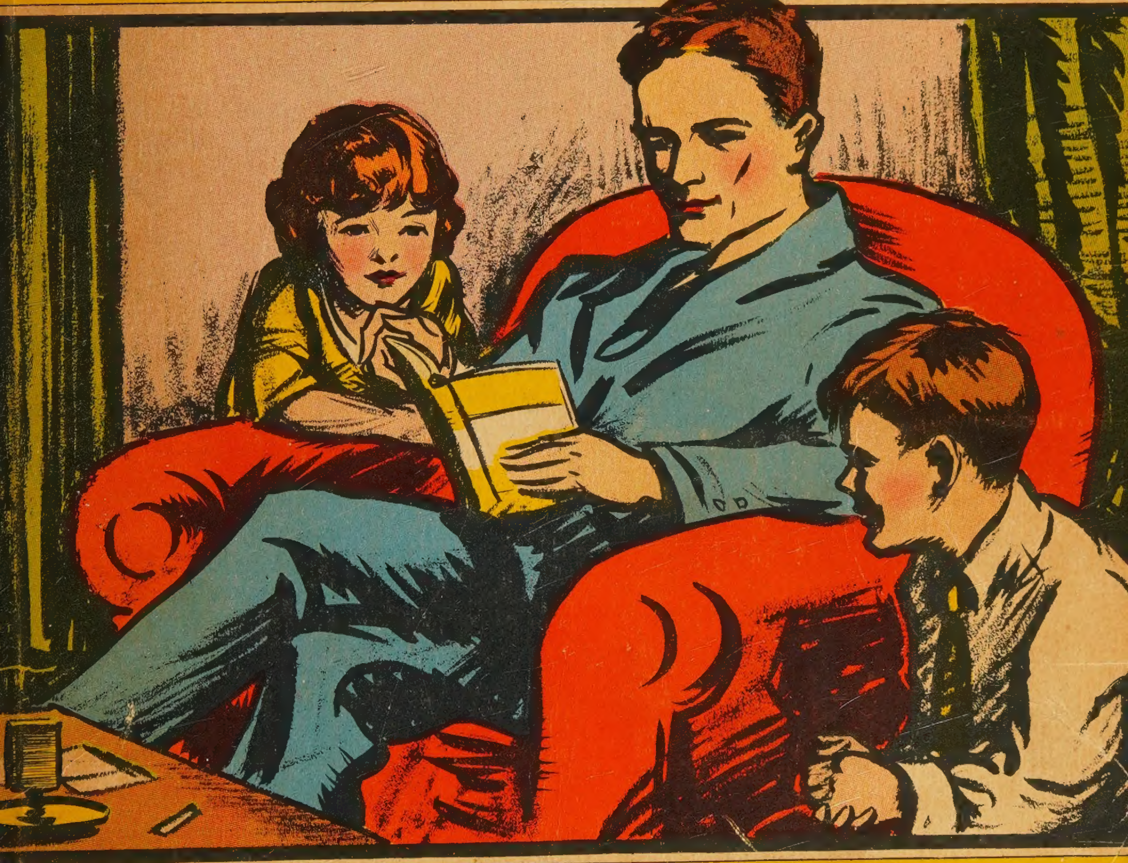
THE WANT to KNOW BOOK



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THE WANT TO KNOW BOOK

208 Pages

of

Facts, Information and Interesting Items

WE ALL WANT TO KNOW

The Want To Know Book

By
ALFRED O. SHEDD

208 pages of interesting items and facts that make for knowledge and information for all of us

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Do You Know?

That A Tender Little Plant Can Push Through A Hard Concrete Walk?

You have probably never thought of plants as being able to exert pressure. Yet they do, especially in spring and early summer, when all plants are growing faster than at any other time of the year. Sometimes this pressure amounts to as much as that in the boiler of a locomotive. But you need not be afraid that the plants in your garden will explode with all this pressure, for they will not. The pressure they exert is not like the pressure of steam in a boiler; it is really more like the pressure that you use when you push a table across the floor or a book across the top of the table.

Now you may, perhaps, be able to understand how a soft little seedling plant can push through hard, compact soil, or even through cement. Each one of the tiny cells in the plant exerts this pressure against whatever stands in the plant's way. If a young seedling, just starting to grow, finds a hard layer of earth or a solid wall of concrete above it, it crowds against the obstacle as hard as it can. The little plant grows larger each day and keeps up this pressure constantly, until finally it breaks a hole through the hard soil or cement, and from then on the plant grows just as any other plant does.

How The Sandwich Originated?

The sandwich is such a common thing that probably you have never stopped to think how it originated. Nevertheless, it was invented for a special purpose, and took its name from the person who originated it. At least that is what we are told.

According to the story, the originator was the fourth Earl of Sandwich, who lived in England during the period just preceding the American Revolutionary War. He was a man who was very fond of all kinds of games and sports. Sometimes he became so much interested in his games that he did not like to leave them long enough to go into the house and sit down to an elaborate dinner. So, at these times, he would ask his servants to cut a number of pieces of bread and then put a slice of meat between every two pieces. In this way he could have a fairly nourishing lunch which he could eat without leaving his sports. Others soon followed the Earl's example, and before long the custom had spread everywhere. Finally the two pieces of bread with a slice of meat between became known as a "sandwich."

What Happens When You Mail A Letter?

When you drop a letter or a post card into a box, you probably forget all about it until you receive a reply from it; at least, you do not have to think about it, for Uncle Sam takes care of that. But have you ever wished that you could follow along behind your letter and see just what

happens to it from the time you put it in the box until it reaches the one to whom it is directed?

Let us suppose that we can see everything that happens to it. The first thing, of course, is the collection. When it reaches the post office, it is dropped, with hundreds of others, on a table. There it awaits its turn for attention, and finally it is taken up and fed into a machine which stamps it with the postmark. Then it is dropped into a sack that is marked for the state to which your letter is going.

A wagon or an automobile takes the sack to the railroad station, where it is loaded on the next train. If this train has a railroad post office in it the sack is opened, and your letter is placed, with others from other sacks, in a compartment holding the letters going to the same city or town to which yours is directed. When this town is reached, all the letters for it, which have been put into a sack of their own, are left at the station. The sack is then carried to the post office of this town.

At the post office the sack is opened, and the letters are sorted into "pigeonholes," according to the street and number of the house on the street. Your letter goes into its proper pigeonhole. Then, after all the letters have been sorted, the letter-carrier takes out the letters in the order of the streets and houses on his route and ties them into little bundles for each street or section. Finally, when the carrier arrives at the house where your letter is to go, he finds the letter right on top, without hunting for it.

Your letter has traveled the whole long distance for only two cents and with no more directions as to how to get there than the name of the state, the town, and the street on the envelope.

How To Tell How Far Away Lightning Is?

Unless lightning is very, very near us when it strikes, there is always a little interval of time between the lightning flash and the sound of thunder. This is because light travels much faster than sound; in fact, the light from a lightning flash reaches us almost instantly, and the sound of the thunder pokes along at the comparatively slow rate of a little less than 1100 feet a second. The difference is about the same as that between the speed of a bullet and the speed of a person walking. If you should shoot a bullet at a certain mark and then start to walk toward that mark you would get the same idea of the difference in speed between the lightning flash and the sound of the thunder. The bullet, of course, represents the light speeding along, and you would represent the sound of the thunder moving along slowly after the light flash.

This great difference in the speed of light and sound gives us an opportunity to tell just how far away a lightning flash is. Remembering that sound travels about one-fifth of a mile a second, if we count the number of seconds between

the lightning flash and the sound of the thunder, and then divide this number by five (five seconds for each mile) we will have the distance in miles between us and the lightning.

Let us suppose that we are sitting where we can watch an approaching thunderstorm. Suddenly we see a flash of lightning in the dark clouds near the horizon. Then we count the number of seconds between this flash and the moment we hear the crash of thunder. We can do this either with a watch or by counting like this: "One-thousand-one, one-thousand-two," etc. (It takes just about a second to say "one-thousand-one.") In this case we find that twenty-five seconds have passed between the time when we saw the lightning flash and the time when the thunder sound finally reached us. From this we know that the lightning that we saw was about five miles away.

So you see it is very easy to find out just how far away a thunderstorm is, and how fast it is approaching. You can even tell, somewhere near at least, how high the clouds are during the storm. To do this, watch for a flash between the clouds that are just overhead and then figure out the distance in the usual way. You will have to be quick about it, though, for sometimes the clouds are quite low, and then the thunder reaches you within a few seconds after you see the flash of lightning.

That There Is an Insect That Lives in a House Made of Bubbles?

Some insects live in very queer houses, but I think you will agree with me that a house made of bubbles is about the queerest place in which to live.

You have probably seen hundreds of these bubble-houses and not known what they were. Or perhaps you thought

you knew. Someone may have told you that they were made by frogs, snakes, or cows. But frogs, snakes, and cows have nothing whatever to do with them.

If you want to get at the secret of this bubble-house you must blow the bubbles aside and catch a glimpse of the little inhabitant of the house before he crawls away. He is an odd-looking little insect—not much larger than the head of a pin, but he can make in a short time a bubble-house that is many times as large as he is. Now if you should undertake to make a house of soap bubbles large

enough for you to live in, it would take you a long time, wouldn't it? Yet our little bubble-house-maker can do this for himself and he can keep it up all day long, faster than the sun and wind can dry the bubbles too.

Now I suppose you are wondering how this little insect makes his bubbles. Certainly he knows nothing of soap or of bubble pipes. But he does not need to know either of these. He simply inserts his beak into the stem of the grass or the weed that he happens to be upon, and he takes in such quantities of sap through this beak that it oozes out from his body in little bubbles. He makes these bubbles so fast that in a short time a big foamy mass covers the little bubble-maker completely. And here he stays, day after day, turning out new bubbles as fast as they are needed to take the place of those that have dried up.

After a few weeks he turns into an adult "frog-hopper" and leaves his bubble-house, to spend the rest of his life jumping about on plants from stem to stem.

The Songs Of Insects?

On warm summer evenings the katydids and crickets sing away at top speed. But, when autumn approaches and the evenings begin to grow cool, their notes become slower and slower. The katydid, that sings his song so fast on warm August nights that you can hardly tell his "katys" from his "dids," begins in September to drag out his song so that each of his three notes is very distinct. We can hear him say very plainly, "ka-ty-did," with an interval before his next "ka-ty-did." Then, as the nights grow cooler still, he drags out each note more and more, so that

just before it becomes so cool that he stops altogether, he sounds as if he could hardly keep awake long enough to rasp out even one note. "K-a-a-a—t-y-y——k-a-a-a," he says and leaves the rest unfinished.

It is the same with the cricket, except, of course, the cricket has only one note to the katydid's three, and so he can manage that one note fairly well, even when he is half asleep on a cool evening. The cricket's song is also more regular than the katydid's, especially when it is cool; that is, at a given temperature he always gives the same number of chirps a minute. You might count them some evening, over and over again, and you will find that the number of chirps is always the same each time you try it. Then, if the next night is cooler, you would find that each time you count the chirps they are the same one minute as the next, but that they are less than those of the evening before.

Now, because the cricket's song is so regular, and because he always gives the same number of chirps at a given temperature, it is possible to tell the temperature fairly accurately by his chirps. The easiest way to do this is to count the number of chirps in a minute, subtract 40 from this number, divide the result by 4, and then add 50. For example, let us suppose that your cricket has chirped 60 times within one minute (this would be one chirp each second). You subtract 40 from 60. This leaves 20. Now, dividing 20 by 4 gives 5. Then, adding this 5 to 50 gives 55, the temperature of the air when the cricket was singing.

Do You Know?

Why Waves "Break" On A Shore

If you are fortunate enough to visit a large lake or the seashore this summer, you will probably see the "breakers" on the shore many times. Perhaps you will wonder just why the waves break and why it is that the tops of the waves pour forward like a waterfall every time they break.

You will notice that when the waves are far from shore they are broad and low, but as they get nearer to the shore they become narrower and higher. Finally, the nearest wave gets so narrow that it is a mere ridge of water. Then the top of this ridge suddenly tumbles forward with a roar, and we say that the wave is breaking.

Now the reason that a wave acts in this strange way is that when it nears a long, sloping shore, the lower part of the wave drags on the bottom, so that the top part goes faster than the lower part until finally it tips over forward and "breaks." When the waves are large they commence to "drag bottom" sooner than when they are small, and so they break farther from shore than they would if they were smaller. When the bottom of the beach is very even, each wave will break evenly; but if it is deeper at one place than it is at another at the same distance from shore, the wave will break first at the shallower place, and the rest of the wave will wait until it gets nearer shore before it breaks.

What Thunder Is?

I have already told you something about thunder and how fast it travels. Perhaps you would like to know now what thunder really is; or rather, just how it is made. Of course we can say that thunder is only a very loud noise; but that does not explain how this noise starts in the first place.

I think everyone knows that it is the lightning that causes the thunder, and not the thunder that causes the lightning. What really happens up there in the sky is this: When lightning jumps from one cloud to another, or from clouds to the earth, it goes through the air at a tremendous speed. "Like lightning," we often say when we mean that something moves very, very quickly. Now when this streak of lightning dashes through the air at this tremendous speed, it leaves an empty space in the air; that is, it goes so fast that the air does not have time to flow back to its place again quietly, as it does when you walk or swing a bat through the air.

So when this air comes together again suddenly after the lightning has passed through it, it comes together with such force that it bounces back again and again, and this starts the sound vibrations that we call thunder. This sound is echoed back and forth from cloud to cloud and from the clouds to the earth; so, if it comes from a distance, by the time it reaches us it is usually just one long rumble.

If you draw a fairly large stick through the still water of

a pond, just as quickly as you possibly can, you will get some idea of how the air comes together again after the lightning has passed through it. The stick will represent the lightning; and the water, the air. If you are successful in this little experiment, the water will come together again all at once with a little slap, and this will represent the first snap of thunder.

What Horses' Tails Are For?

You probably know the answer to this question already. "To brush the flies off their backs," you say. Yes, that is right. But if I should ask you how horses help one another with their tails, you probably could not answer so easily.

You can see, almost any day in summer, a horse using his tail to brush flies off himself; but, if you want to see a horse brushing flies from another horse, you will have to go where two or more horses are out of their harnesses and in a pasture together. If the day is warm and there is no breeze, you will probably see them grouped under a tree or grazing leisurely in some corner of the field. Watch them closely. You will seldom see one horse out of the reach of another horse's tail. Sometimes you will see two of them side by side, facing in opposite directions, so that the tail of one brushes the nose of the other. Another time there may be a ring of horses, head to tail; or three or four may be strung out in single file, one directly behind another.

Now you may wonder how or why a horse helps another horse by brushing his nose. Well, the secret of it is this: There is a certain kind of fly that lays its eggs on the hairs near a horse's mouth; and when the horse swallows these eggs, they hatch in his stomach and make him ill. A horse seems to know that these flies should be kept away from his mouth or nose; and as his own tail is not long enough to reach around to his nose, he tries to keep within range of the constantly switching tail of another horse.

The Best Colors For Signs?

If you wished to paint a placard, and wanted it to be as legible as possible from a distance, what color card would you select, and what color paint would you use?

It has been found that the most legible combination is black letters on yellow paper. The other combinations, which have been tested, have been found to be legible in the following order. These experiments were made with the distance from the eye, the size and form of type, and other factors exactly the same in each instance, the only difference being in the combination of colors.

The following list gives the order of legibility:

1. Black letters on yellow paper.
2. Green letters on white paper.
3. Blue letters on white paper.
4. White letters on blue paper.
5. Black letters on white paper.
6. Yellow letters on black paper.
7. White letters on red paper.
8. White letters on green paper.
9. White letters on black paper.
10. Red letters on yellow paper.

How To Make A Water Compass?

Anyone who has a ten-cent magnet may do all sorts of interesting stunts with it. Among other things, a simple compass can be made that will work almost as well as an expensive instrument. To do this, select a large needle and draw it along one arm of the magnet several times, always in the same direction. Now, fill a bowl or basin half full of water and place a flat milk bottle cap or other round piece of cardboard on the surface of the water. Drop the magnetized needle carefully upon the cardboard, and your compass is complete. If you have done your work correctly, the needle and cardboard will swing around in the water until the needle points to the north.

What The Torpedoes On A Railroad Track Mean?

When you are riding on a railroad train, or when you happen to be near a track while a train is going by, you sometimes hear a loud bang or a bang—bang. Then the train slows up and perhaps stops altogether. Now what is it that makes these loud bangs, and why should an engineer have to be signalled to with shots loud enough to be heard nearly a mile away?

These torpedoes, or detonators, that make the noise are not so large as you might suppose from the noise they make. They are made of metal and are about two inches square

and half an inch high. On the sides of each one there are two leaden strips that can be bent down over the edges of the rail to fasten it to the track. Each one of these little torpedoes is really a flat cartridge filled with a high-powered explosive which "goes off" with a loud noise when it is struck by the wheels of the locomotive. The reason it has to make such a loud noise is that when the train is going fast, the noise of the engine and cars on the track would prevent the engineer from hearing it if it were not loud.

Of course, engineers usually get their signals or orders from a station, or by watching the signals beside the track. But sometimes there is no way of letting an approaching train know that there is danger ahead except by leaving some signal on the track. Flags are often used for this, but usually it is not convenient to use flags, for they have to be picked up again. It is easier to leave something that will not have to be picked up again after it has done its work of signalling; so the torpedo is used.

Now in using these torpedoes, it is sometimes necessary to warn the engineer of an approaching train that there is danger ahead. If the danger is near, one torpedo is placed on the track. That means to come to a full stop at once. But if it is only necessary to let the engineer know that he must slow down and drive carefully, two torpedoes are put on the track. Then the engineer knows that he must reduce his speed and watch very carefully for other danger signals that may be along the track.

You will not hear the single torpedo very often, for it is seldom that a train has to be stopped that way. Two torpedoes are much more frequent. This is what usually happens when you hear the two bangs: A train has had to stop for a minute or two, and the trainmen know that another train may come along that same track within a few minutes. So the flagman goes back some distance and places a red light on the track; then he goes back farther, places two torpedoes on the track, and returns to the train. Soon the second train comes tearing along the track at a fast speed, when—bang!—bang! sound the torpedoes on the track. The engineer hears them and slows up. When he rounds the next bend he sees the red light burning. Now a red light on a railroad track, you know, means stop! So he stops the train and waits until the red light has burned out. Then he knows that the first train has got far enough ahead again to be out of the way.

How The Writing Pen Got Its Name?

Probably every one of you owns some sort of pen. Probably it is a steel pen with a wooden holder, or it may be a fountain pen with a gold point and a hard rubber case. But if you had lived a hundred years ago, your pen would very likely have been nothing more than a sharpened feather.

Perhaps you think that a feather would be a very queer thing to write with. Well, it may not be quite as good as your gold fountain pen, but if you should whittle down a large stiff feather to a fine point, you would find that you could write fairly well with it.

For many, many years people had to use feathers for pens, and because feathers were used so much, the name pen was given to them. This word pen comes from the Latin word penna, which means a feather.

During all these years that people used feathers for pens the greatest trouble they had with them was that they wore down so fast they needed sharpening very often. So they made little knives with small, sharp blades to carry around in their pockets, ready to sharpen their feather pens whenever they became dull. These little knives they called pen-knives, because they were used almost altogether for sharpening pens.

Now you probably have a pen-knife as well as a pen. But your pen is not a feather, and you do not use your pen-knife for sharpening your pen. The next time you use a pen or a pen-knife, though, you will know why a pen is called a pen, and a pen-knife is called a pen-knife.

Do You Know?

What Asbestos Is Made Of?

You have probably seen asbestos cloth or paper many times. Perhaps it is used in your home to cover the steam pipes; the fireless cooker may be lined with it; or your mother may have several asbestos pads for setting hot dishes on. And you probably know that asbestos cannot burn, even if it does look as if it could.

Nearly everyone thinks that asbestos hasn't been used many years. Well, it wasn't used very much until about forty or fifty years ago. But no one knows when it was used first. We do know that the ancient Greeks, nearly 3000 years ago, sometimes made handkerchiefs and aprons of it. Also, nearly 2000 years later, Emperor Charlemagne, who lived about the year 800, had a tablecloth woven from asbestos. And how do you suppose the ancient Greeks and Charlemagne's servants washed these clothes made of asbestos? They threw them into the fire and let the flames burn off the dirt!

Now if you do not know just what asbestos cloth is made of, all this may seem rather puzzling to you. And if I should tell you that it is made from a rock—or more exactly, a mineral—you would be more puzzled still, wouldn't you? But if you could see and handle a piece of asbestos as it is mined from the rocks

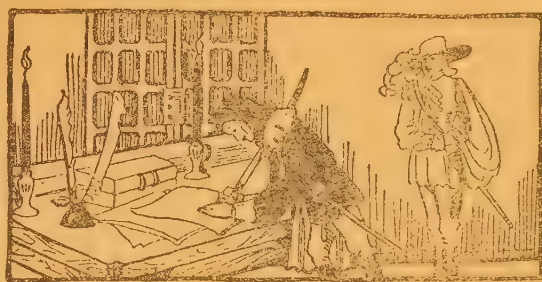
in the earth, I think you would understand how asbestos cloth can be made from a mineral. Asbestos rock is made up of thousands of tiny fibers, all running in one direction. If you should hit a piece a sharp blow with a hammer, it would crumble up into a mass of silky fibers. Now it is these fibers that make it possible to weave asbestos into cloth or press it into paper; just as cloth is woven from the fibers that make up thread, and paper is pressed out from fibers of wood. Really, the main difference between asbestos cloth or paper, and other kinds of cloth or paper is that the fibers of asbestos cannot burn and the other fibers can. And the reason asbestos fibers cannot burn is because they come from a mineral, instead of from a plant or animal; and minerals, you know, never burn.

That Seals Were Once Used Instead of Signatures?

Of course you are able to write your own name. And whenever you sign your name, you write your signature. This is easy for you to do; but there was a time, many years ago, when hardly anyone could write his name. That was because there were so few schools, and because it cost so much to go to school; also, many persons had the strange notion that it was not necessary for them to learn.

Now all of these people who could not write had to have some way of making their signatures. So each one had a seal that he used when he wanted to stamp his signature on anything. You may have made a seal or seen one that has been made. You know that it is usually done by melting some red sealing-wax on to the place where the seal is to be, and then stamping the soft wax with the seal before the wax hardens.

These old seals were made all sorts of ways. Most of them were something like the rubber stamps that you have seen used in ticket offices. They were carried about in a pocket or a bag, and were used only as seals. But some were fastened on to things used for other purposes. For example, a man often had his seal engraved or carved on the hilt end of his sword. And as every man in the upper classes always carried his sword with him in olden times, his seal was thus always with him too. When he wished to make a seal, he merely held his sword with the blade pointing up in the air, and brought the seal end down on the paper or whatever he was signing.



One of the most popular ways of carrying a seal was to have it made on a finger ring. You have probably seen a signet ring. Perhaps you have one yourself. If so, you will have a good idea of the old ring seals that people used for many centuries. The signet ring is really a direct descendant of these ring seals. The very name "signet" means the same thing as "signature." Of course you do not have to use your signet ring to make your signature, but if you had carved on the face of the ring a design that no one else had, and if you could not write your name, you would see how useful to you your ring would then be.

Why Lions Roar?

If the first day or two of March this year is cold and very windy, you will probably hear some one say, "Well, March is coming in like a lion!" The reason people say this is because the high winds sound something like a lion's roar. Perhaps you have been to a circus or a zoo and have heard a lion roar. I was once in a lion house at a zoo when six lions were roaring all at the same time, and they made so much noise that the very walls of the building trembled.

Well, anyway, you know that lions do roar, but do you know why they roar? To find this out we will have to go to the jungles where the wild lions live, and watch them while they do their hunting.

A lion hunts in two ways. First, he prowls about and searches for prey, just as you may have seen your pet pussy cat do when he was prowling about in the meadow for mice. But if the lion is not successful in finding anything to catch this way, he creeps quietly up on to a little rise of ground or to the edge of a cliff, and then suddenly he gives a loud roar. Now if you were right near this lion when that awful roar broke the stillness of the jungle, you would be startled, wouldn't you? And probably you would jump and move your arms or legs quickly. Well, that is exactly what most of the smaller, more timid animals do. The lion is sure to see one of them or to hear a twig snap or a leaf rustle. Then he pounces on his prey.

Of course, lions roar for other reasons too. They roar when they fight or when they are angry, and sometimes

they roar "just for the fun of it." But most of the roars that you would hear if you were living in the jungles where the lions live, would be the roars that lions make to frighten their prey.

How High Clouds Are?

Have you ever wondered how high above your head the clouds are, or how high you would have to fly in an aeroplane to reach them? Clouds are sometimes much higher than we think they are. If you had the best aeroplane built, you would never be able to reach some of them.

But clouds are not always so high that you cannot reach them with an aeroplane. In fact, most of them are quite low—usually about a mile high—and you know that any good aeroplane could easily go above that height. Sometimes they are even lower than this. During a warm winter rainstorm they often come down to a quarter of a mile above us. Then if you live near a high hill or mountain you will see just how low they really are, for they will hide the top of the hill and sometimes come far down over its side.

The big, white, foamy clouds that look like puffs of steam from a locomotive are usually about a mile above us. That is, their bases are about a mile; their tops are often two miles above us. If you should go up on to a very high mountain, you might be able to look down on the tops of these clouds.

But there are some kinds of clouds that nobody has ever seen the upper sides of, and probably no one ever will. You

may have noticed, some day when the weather was fair, a lot of tiny white, feathery clouds that looked very, very far away. Well, they were far away. In summer these clouds are usually six miles high, but in winter they are sometimes as high as ten or even twelve miles. So, you see, that is the reason you would never be able to reach these clouds, even with an aeroplane.

Why Stars Twinkle?

When you look at the sky on a clear, cold evening in winter, the stars seem to be continually twinkling and dancing about as you watch them. But the stars do not move about, nor do they flicker, as a lamp sometimes does. What is it, then, that makes the stars twinkle?

Perhaps you have noticed that when you look over the top of a hot stove at things that are on the other side, these things quiver and dance about just as the stars do. Or you may have looked over a tin roof or over a road when the sun was very bright and hot. The reason that things appear to dance about at these times is that the air between you and the things that dance about is moving very quickly and also very irregularly.

Now something very much like this happens when you are looking at the stars. The air that is between you and the stars is moving rapidly; and as there are usually a number of different currents of air moving at the same time, the motion is very irregular. Even if it is very quiet where you

are, there is almost always a number of strong air currents higher up, especially in winter. And it is this rapidly moving air that makes the stars twinkle. If you will look at those stars near the horizon, you will see that they twinkle even more than those overhead. This is because there is more air between you and these stars than there is between you and those that are above you, and there are consequently more different kinds of currents.

When you look at the lights of a city that is three or four miles away, you will notice that they sometimes twinkle just like stars. This also is caused by strong currents of air that are moving rapidly between you and the lights.

Why Nails Are Sometimes Called "Four-penny," "Six-penny," or "Ten-penny" Nails?

Has your father ever sent you to the store to get some six-penny nails? Or perhaps you went for some nails for yourself, and if you didn't know what size you wanted until you saw some in a bin behind the counter, the storekeeper probably said, "Oh, you want four-penny nails."

When you buy nails that way, you are buying them the same way that people bought them five hundred years ago Of course, you don't pay the same prices for them, and the nails themselves are not just the same as they were then. But when a boy went to a shop to buy nails in 1423 or 1523, he would ask for four-penny nails or six-penny nails just as you do to-day.

All nails were made by hand five hundred years ago. In fact, nails have been made by machinery for only a little over one hundred years. In that long ago time—before Columbus had discovered America, even—the nail makers agreed that all nails should be divided up into about ten sizes and should sell for so many pence (pennies) a hundred, according to the size of the nail. You see, a one-penny nail was very small, and a hundred of them wouldn't weigh much; but a ten-penny nail was about ten times as large and a hundred of them weighed much more than one hundred one-penny nails.

Nails are not always sold that way now. You might go into a store and the only way they sell them is by the inch. That is, you might get fifty cents worth of inch-and-one-half nails or two-inch nails. But the next time you hear any one speak of four-penny or six-penny nails, you will know why they are called four-penny or six-penny nails.

Do You Know?

That There is an Insect That Can Drill A Hole In Wood Four Inches Deep?

You are probably saying to yourself, "Oh, I have seen a hole made by an insect that was over one foot long." Yes, of course, every one has seen these long holes in dead pieces of wood. But those holes were bored or chewed. The ones I am talking about were really drilled. It is easy enough for a boring insect to eat his way through wood by biting off little chips at a time. The insect that I mean, however, has a real drill, which works just as well as your own gimlet or bit; in fact, it works better than your gimlet, for it can make a clean hole four inches long, and no larger than the thickness of a pin. And what is more, this little drill looks and feels just like an ordinary horse hair!

That is the remarkable part of it. If you should happen to see Mrs. Ichneumon Fly (for that is the name of the insect that owns this wonderful drill) when she first alights on a dead limb or on an old log and starts drilling operations, you would wonder how in the world she could make even a scratch on that hard wood. She is a very slender insect, about the size of a small wasp, and

her drill looks just like two or three long black hairs stretching out backwards for about five inches, like a tail. When she has found the spot where she wants to start drilling, she curls that long "tail" of hers over her back, making

a little loop, and brings the end of the drill straight down to the wood just in front of her last pair of legs.

Then the drilling starts. It is a long, hard job to make that hole. But she has lots of patience,—even more than you would have to stay there until she had finished the work, for it sometimes takes several hours to do it. If you watch her closely you will see a little quivering motion of the membrane that stretches across the loop. As the work progresses, a tiny pile of sawdust collects around the edge of the hole, and the drill sinks deeper and deeper into the wood.

To get at the secret of this marvelous little drill, we should have to take it apart and look at it under a magnifying glass. When I say "take it apart," you have half of the secret, for instead of being in one piece as it looks to be, it is really made up of several parts. First, there is the outer casing, which acts as a sort of tube to hold the working parts of the drill. There are two of these working parts that slide up and down in the tube, and on the end of each part is a sharp chisel-like edge. That is the other half of the secret. That quivering motion that you saw up there on the loop was making these two chisel-pointed parts work up and down rapidly, cutting a tiny chip from the bottom of the hole each time.

Now, I know you are anxious to find out what all this boring is about. Well, in the first place, it is only Mrs. Ichneumon Fly that does the boring, for the sole purpose of that long drilling job is to lay an egg in the burrow of the wood borer. That is the way she provides food for her children. You see, she hunts around until she finds a log or branch in which she knows that there is a big fat wood-boring worm somewhere inside. Then she bores a hole

down to his burrow and lays an egg in it. I forgot to tell you that the working parts of her drill are curved so that they make a second tube through which she lays the egg. When the little Ichneumon grub hatches out, it crawls along the burrow until it finds the wood borer. Then it proceeds to feast on that unfortunate worm until it grows up into a mature Ichneumon fly, and crawls out into the air.

What Burs and Sticktights Are For?

It is hard sometimes for us to find a reason for things that really seem a nuisance to us. How many times have you ever come home from the woods or fields all covered with burs or various kinds of sticktights? And then when your mother made you stay out in the yard until you had picked off "all those old burs" before coming into the house, did you ever say to yourself: "What good are these old things anyway? Why do they have to be so sticky and prickly? I don't see what they were ever made for."

Well, if it seems hard for you to explain some of these things, there is usually a good reason why they are made as they are. Old Mother Nature has reasons for doing everything that she does, even though sometimes the way she does things is not the way we would like them done.

Now you may not have known it, but when you carried home all these burs, you did just what Mother Nature wanted you to do. She purposely made those burs and sticktights so they would cling to anything that brushed them. You see, the more that seeds of any kind are scat-

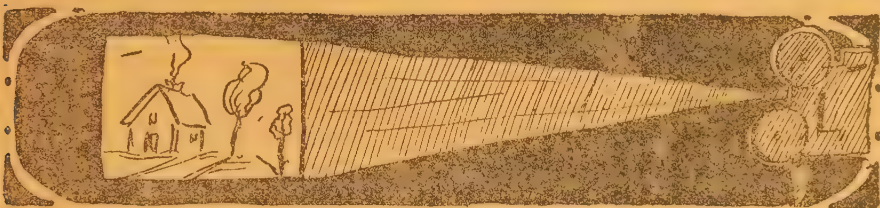
tered, the better it suits Mother Nature. She has all sorts of ways to do this; but one of her best ways is the way she makes the burs and sticktights steal a ride from the first person or animal that touches them. She knows that many of them will get lost, but she also knows that some will be brushed off or picked off and dropped just where she wants them dropped. There they will lie until the following spring, when the seeds in them will sprout and grow up into new plants. Then next fall a new crop of burs and sticktights will be all ready to start on their journeys to their new homes. And perhaps you will be the one to carry some of them!

That the Loon Can "Fly" Under Water

If you have ever tried to swim under water you know how difficult it is to make any great headway. Yet the loon, by using his wings in much the same way that he does in flying, is able to travel under water with great speed. He can even beat most fish in a direct race. In fact, the biggest part of the loon's food is made up of fish, which he gets by chasing through the water. And if you have ever seen a fish going at full speed, you will have some idea of how fast the loon can go.

I do not know whether or not anyone has ever actually determined just how fast a loon travels when he "flies" under water; but I do know that a fast canoe, or even a motor boat, cannot begin to beat him in a direct race.

Do You Know?



That "Movies" Are Now Used By Salesmen In Explaining Their Products?

When a modern salesman wishes to explain to his client the details of manufacturing the product that he represents, he carries a small portable moving picture machine and several reels of pictures. He asks permission to darken the room, then as the client sits in his office chair the whole process of manufacture is brought as vividly before him as if he were making a personal tour of the plant where the product is made. The client is thus in a few moments able to gain a clearer idea of the product and its merits than he would by hours of talking on the salesman's part.

Where Your Christmas Tree Comes From?

I once asked a little girl who lived in the city if she knew where her Christmas tree came from, and she said, "From the store." Now if you live in the city, or if you live on the great prairies and have never seen a Christmas tree really growing, you would probably give the same answer. But of course you know that your Christmas tree grew somewhere. Certainly it did not grow in the store!

Let us imagine that we can travel about the country just as easily as Santa Claus can, so that we can watch the Christmas tree that you are going to have this year, as it takes its long journey from the deep woods to your home.

Santa Claus, you know, can get from one place to another almost as quickly as you can think. So—dash—here we are in the northern woods where the Christmas trees grow. It is very cold up here and the snow is deep. There are hundreds of "really truly" Christmas trees all about us—from little baby trees just peeping above the snow, to big giant trees such as you have seen all lighted up on the common or the public square.

As we stand here in the snow, looking at all these pretty Christmas trees in their dark green coats and wondering which one is yours, along comes a man with an axe in his hand, trudging through the snow. He is the man who is going to cut your Christmas tree. He glances at this tree and at that. Sometimes he looks at one from all sides and then passes on to another. You see, he

selects only the perfect trees and many of them are not perfect, so he leaves them. Finally, he stops before one very pretty little tree that is just a little taller than he is. Whack, whack, sounds his sharp axe, so quickly that before you have had time to wonder if he is going to cut it or not, it is already cut and on his shoulder. Your Christmas tree has started its journey to your home, perhaps many hundreds of miles away.

Hurrying after the man that has your Christmas tree on his shoulder as he moves quickly away, we see him finally drop it down with a lot of others. Soon another man takes up your tree, ties all the branches flat against the trunk, and tosses it into a big sledge. When the sledge is full, off

it jolts and slides down the rough road until it comes to the railroad station. There your tree is loaded, with hundreds of others, onto a big freight car. Then it travels over the rails to the city in which you live, or to the largest city near you. Here it may stay a day or two until it finally goes to the store or market.

You know just what will happen to it after that. Perhaps Father will come home with it some evening, perhaps the delivery man will bring it, or perhaps you will get it yourself. Anyway, when you do get it, it will seem like an old friend to you, now that you have taken an imaginary journey to the northern woods, seen just where it grew, and watched it in its long journey from the snowy woods to your home.

How Many Leaves A Tree Has?

Have you ever lain on your back on a hot summer afternoon and looked up into the branches of a big maple tree? And have you ever wondered how many leaves there were on this tree? Perhaps you even started to count them, and then gave up after you have counted a hundred or so. Probably you came to the conclusion that "there must be a million of them."

I don't believe that any one has ever actually counted every leaf on a big tree, for it would be almost impossible to do this. But men who have made a study of trees have estimated how many leaves there are on different trees. And when they came to the maple tree they estimated that an average full-grown maple tree has about forty or fifty thousand leaves on it. Of course every tree is different. Some full-grown maples may not have half that number, and

others might have nearly twice as many. Some other kinds of trees, trees that are very small when full grown, might have only one or two thousand, or even less. And some trees that are larger than a full-grown maple might have more than a hundred thousand. You see, you can't say that all full-grown trees have forty or fifty thousand leaves. That would be just as wrong as to say that all full-grown persons were six feet tall.

Well, let us suppose that the maple tree that you are looking up into has exactly 45,000 leaves, which is a fair average for a mature maple. Let us also suppose that each leaf contains an average of about fifteen square inches. If we were to spread all the leaves from your maple tree over a level piece of ground so that every bit of ground were covered, we should find that it would take about a quarter of an acre to spread them all out. Now, of course, a leaf has two sides, so there is really double that amount of surface on these leaves. We can therefore say that there is about a half an acre of leaf surface exposed on your maple tree.

Do You Know?

That Many Of Our Modern Roads Follow Old Indian Trails?

When you are riding along in an automobile over one of our many great national or state roads, or when you are speeding along on a train over one of the big railroads, do you ever think how much easier it is for you to travel a long distance than it was for the Indian, who had to depend on his feet or on a canoe? And yet it was the Indian that really laid out and started the courses followed by many of the roads we now use so much.

The Indian knew how to select the shortest and easiest path that could be made between two distant points. The path was not always straight. In fact, it was more often crooked and winding; but taking everything into account, it was the straightest and most level path that could be found. These trails often followed a stream, if the stream led in the right direction. Sometimes, in the Northeastern States, they ran along the top of an esker, which is a long, level ridge of gravel and sand made by the great glacier that once covered the whole of the land where the Northern States now are. But most often they just led right across the country. They went around the highest hills, followed the valleys where they could, crossed the streams at the easiest crossing place, found the nearest pass over a mountain range, and always made their path where the traveling would be the easiest.

Now when the white settlers came and began to need long highways from one distant settlement or region to another, they found that the courses taken by the old Indian

trails usually could not be improved upon. So they just made them wider, filled a few of the hollows, and smoothed the rest over. For many years these roads were used by stagecoach routes and by the settlers in going from one place to another. Of course, other roads were made,—many of them, but most of the first roads through long stretches of wilderness were built on these old Indian trails.

As the years went by these old roads were used more and more. Sometimes they were changed a little here and there to make them more level, but they always followed the same

general route. Then when the railroads commenced to lay their tracks over the country, many of them were built right beside these roads. In New York state to-day fast express trains, automobiles, and canal barges all follow the old Mohawk trail that was used by the Iroquois Indians for many centuries before the white man came. In the Southeast two railroads travel over the great Indian trail, or Wilderness Road, that led from Maryland and Virginia into Kentucky and Ohio. The old Santa Fe trail in the Southwest, and the Oregon trail in the Northwest, are two more great trails that afterward became stagecoach and railroad routes. And everywhere there are shorter roads, used to-day by thousands of automobiles and trucks, but first laid out by Indians.

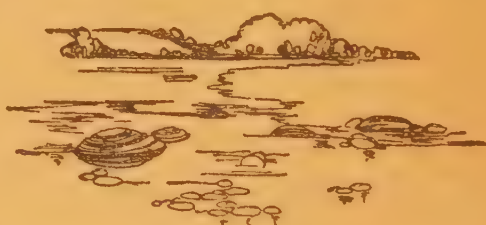
So, you see, when you ride over these roads to-day, you are traveling over the very same trails that the Indians traveled over when they went out to battle, to hunt, or to the council fire.

How The Clam Gets His Shell?

I suppose you have been either to the seashore or to a lake this summer. And if you were, you must have picked up shells of some kind. If you went to the seashore, you perhaps made a fine collection of them. Did you ever wonder where the clams or snails, or whatever lived in those shells, got them in the first place? "Why, they grew on them," you say. Well, yes, that is partly right; but they didn't grow the way the hair grows on your head or the skin

on your body. The hair on your head and the skin on your body grow without your doing anything to them. But the clam has to make his shell grow. And he does this by adding a little bit to it every time it commences to get too small for him,—just as we might add a little cloth to our clothing to make it big enough for us when we commence to outgrow it.

The clam has an easier way of making his shell big enough to cover him than we have of making our clothing big enough to cover us. All he does, when he finds that his coat is becoming too small to fit him properly, is to push out his "mantle" and build up the edge of his shell until it does cover him. This



mantle is his shell factory. When he starts it working, a layer of shell material is gradually built up underneath it. It is just a thin, white, soft layer of fleshy material that lies between the main part of his body and his shell. The clam protrudes this white layer just far enough to cover the outer edge of both halves of his shell. Then he secretes a limy substance. At first this substance is like a thick liquid, but it gradually hardens. When the shell has been built up enough, the clam pulls the mantle back in again. And if we could see him right then, we would notice a very clean-looking, pearl-like border on the edge of the old part of his shell.

The next time you see a clam shell, look at it closely, and you will see a lot of irregular lines on the outside of the shell. These lines show just where "new additions" to his shell house were put on.

The Potato?

You probably have potatoes to eat nearly every day, but did you ever stop to think just what a potato is? A potato is not a root and it is not a fruit and it is not a seed. It is merely an enlarged stem, or tuber.

Potatoes had never been heard of by white people until America was discovered. The Spaniards found them when they came to this country and called them "batatas," because this word sounded like the name the Indians had given them. But the name batata or potato rightfully belongs to what we call the sweet potato, and not to our white potato. (The term "Irish potato" has been applied to the white potato because it played such an important part in the diet of Ireland a number of years ago.)

What we call "eyes" on a potato are merely buds. They correspond to the buds on a stem. A new vine will start to grow out of the eye or bud when the potato is planted the following season.

The potato has many relatives that differ greatly from it. Tobacco belongs to the same great family of plants; so does the tomato, the eggplant, and the peppers. Many of its relatives are very poisonous, such as the nightshade and Jimson weed. Potatoes that grow above the ground are poisonous, at least they possess the bitter chemicals that make the plant itself poisonous or intensely disagreeable to the human system.

By cultivating potatoes for the sake of the tubers and not for the vines we have been able to produce many varieties

of potatoes, but have neglected the vine until it does not amount to much. In its wild state the vine or shrub is very hard, and grows to a considerable height. The Indians cultivated the tobacco plant for the leaves, hence the leaves and stalk of the tobacco are large, while there is no sign of tubers at the roots.

That You Can Often Discover The Source Of Small Winds?

You may learn many interesting things about air currents and the way storms develop by watching the movement of pieces of paper, or perhaps your hat, as it is whirled about the street. A variety of miniature wind storms are developed by the high buildings of our cities or by the forms of streets. On a hot day, even when the air is perfectly quiet, the atmosphere, as it becomes heated, tends to rise against the sides of rocks or buildings, and if it travels far enough will develop in a strong wind, which descends on the opposite side and plays queer pranks. A small whirlwind is often produced by the action of wind against a corner formed by several buildings. As the wind travels down a street again, especially a narrow one, it rapidly increases in velocity.

If you sit near the base of a waterfall, you will notice, on a calm summer day, that there are many cooling breezes, eddies, and cross currents. All these are set in motion by the water as it rushes over the cliff, and displaces the air below.

How Water Striders Can Walk On Top Of The Water?

If you have ever watched the little water strider, or "water skater" as he is sometimes called, you know that he actually walks right on top of the water. How does he manage to do it? What kind of magic shoes does he wear that enable him to walk on the water as easily as he walks on the land?

Really, there is no magic at all in his feet although it seems magic. Perhaps the best way to get at the secret is to try to imagine that the surface of the water is something like the film of which a soap bubble is made. Of course, you mustn't think that the surface of the water is just like the film on a soap bubble, for it isn't. The only way it is like it is that it bends just a little before it breaks. And because it is able to bend a little, it is able to hold up things much better than it would if it could not bend. You may have seen some one do the "trick" of making a needle float on its side. It is because the surface of the water can bend under the weight of the needle without breaking that makes it possible to float a needle.

Now it should be easy for you to understand how a water strider can walk on the water without falling through. His "feet" are long and covered with fine hairs, and he is rather light in weight anyway. Besides being long and covered with hairs, his feet are always in a perfectly flat position on the water, just as the needle is when it is floated.

There you are! The strider can stay on top of the water because his feet are so made that they never break through the surface. The next time you see a strider, look very carefully at his feet. You will see that each one is in the center of a very tiny hollow on the surface of the water. And if the sun is shining on him, notice the little shadows on the bottom of the pond or brook with circles of light around them. These are made by the little depressions around his feet.

Why A Fly Can Walk On A Ceiling Without Falling Off?

Have you ever wondered what keeps a fly from falling when he walks quickly up a window pane or rests, back downward, on the ceiling for hours? You know very well what would happen to you if you tried these stunts!

Perhaps if you were as small as a fly and could make glue with your feet as you walked along, you might be able to walk on the ceiling without falling off. Now you have the secret of it. A fly is very, very light, you know. And on the ends of each foot are many tiny hollow hairs, through which he can send out a sticky fluid whenever he needs to keep himself from falling off a smooth surface. Sometimes, of course, the surface is so rough that he cannot use his "sticky feet." For such places he uses little hooks that catch on the rough places and hold him up.

Do You Know?

How Much A Caterpillar Eats Before He Becomes A Butterfly?

Have you ever seen a caterpillar when he was not eating? Perhaps you have, but if he is not disturbed, you will usually find him chewing away for all he is worth at the edge or center of some leaf. From morning until night he eats, eats, eats. Wouldn't you think his jaws would get tired? Well, perhaps the reason they don't get tired is because a caterpillar has two sets of jaws, one working sideways and the other up and down. I suppose it is easier for him to chew this way than it is for us to chew with only one set of jaws.

Of course you know that all real caterpillars don't stay caterpillars all their lives. When they have reached full growth they turn into butterflies or moths. Now most butterflies and moths eat very little. Some do not eat at all after they get their wings, and most of the others eat only nectar from flowers. So, you see, a caterpillar has to eat enough during his caterpillar stage to last him all through his butterfly stage, as well as enough to make him grow while he is a caterpillar.

It is rather easy to find out how much caterpillars eat, for they can easily be kept in a cage and fed. A man once weighed all the leaves that he fed to one caterpillar from the time he was hatched out of the egg to the time he became a butterfly. He found that during the short period of his caterpillar stage, which lasted only several weeks, this hungry, four-jawed caterpillar ate nearly six thousand times as much as his average weight!

How You Can Remember Which Side Of A Boat Is "Port" And Which Is "Starboard?"

If you go to the shore this summer, or even if you take a trip on a big boat on the Great Lakes, or on some of our big rivers, you may hear the words "port" and "starboard" spoken. And if you are on the boat after dark, you may see other boats with a red light on one side and a green one on the other. Now if you do not already know, you would probably like to be able to remember which side is port and which side is starboard, and you would also like to know on which sides the red and green lights are put.

Now there are a number of ways of remembering these facts. Of course, after you have been on board a boat a while you will learn them anyway. But it will be more interesting to you if you learn them now, before you go. And

in order not to forget them, I will tell you a very easy way to remember them.

The first thing to do is to imagine that you are going to throw a ball, first with the left arm, and then with the right. If you are not left-handed, you know that you will be able to throw twice as far with your right arm as with your left. Now, with that in mind, it will be easy for you to remember that port is the left side, because the word "port" is only half as long as the word "starboard." And then you can remember that the red light goes on the port side because the word "red" is shorter than the word "green" which is the color of the light that goes on the starboard side.

How Santa Claus Got His Name?

Of course you know Santa Claus, or at least you know all about him. Perhaps you think he is a real person, or perhaps you think he is just a name. But whatever you think, he was a real person once. That was many, many years ago. And instead of living at the North Pole, as he does today, he lived very far from it—and also very far from us—way off in Asia Minor.

Now when Santa Claus lived in Asia Minor, his name was not Santa Claus, but just Nicholas; and he was a bishop in

the ancient city of Myra. We do not know very much about him, but we do know that he was persecuted for his religion, and that after he died he was called Saint Nicholas.

That is all we really know about Saint Nicholas. But there are many stories about him, that may or may not be true. At any rate, the Greeks and Romans set apart the sixth day of December as his day; and later, Christian people all over the world honored him.

One of the stories about him explains why the Santa Claus of to-day gives presents on Christmas. One time, when Nicholas was living, he heard that unless a poor man in his city had a big sum of money on a certain date, his three daughters would be sold as slaves. Now Nicholas was always doing good wherever he could, and he didn't like to have people know about it either. So just before the day set for the selling of the daughters, Nicholas went to the poor man's home, disguised so that no one knew him, and gave the man the necessary money. Many years after this, when people began to think more of old Saint Nicholas, it became the custom to give presents in secret on the eve of Saint Nicholas Day. This was the way the people honored

Nicholas' generous act to the poor man. Then still later, this custom of giving presents in secret was transferred from Saint Nicholas Eve to Christmas Eve; and that is why the Santa Claus of to-day gives presents in secret on Christmas Eve.

Now you will want to know just how this old Saint Nicholas became our Santa Claus. Well, it came about this way. When the early Dutch colonists came to America, they brought with them this custom of giving presents in secret on Christmas Eve. And the little Dutch children looked for San Nicolaas, as they called Saint Nicholas, to come in secret to their houses, just as you look for Santa Claus today. Now it wasn't long before the children of the English colonists heard about the Dutch San Nicolaas and how he brought presents on Christmas Eve. So they began to talk about San Nicolaas. But of course they couldn't say it just the way the Dutch children could. The nearest they could get to say it correctly was Santa Claus. And that, you see, is really the way our Santa Claus got his name.

Why The Owl Is Called Wise?

You know, of course, that owls do not know everything. They are really no wiser than any other bird. It is true that they look wise; but that is because of their big round staring eyes, and the lines around them that make the owls look as if they wore goggles.

But if we want to know the real reason why owls came to be called wise, we will have to go back many, many centuries—to the time when the Greeks were the most important people in the world, almost three thousand years ago. The ancient Greeks used to worship several different gods and goddesses. One of these goddesses was named Athena. The Greeks built a beautiful temple to honor Athena. Near this temple there was a large olive grove, and in the olive grove there were always a great many owls.

After a while the olive trees near the temple gradually became sacred to Athena, and as the owls were always in the olive trees, they too became sacred to Athena. Now, Athena was the goddess of wisdom; and for this reason the owl has represented wisdom ever since.

Some day you may make a collection of ancient coins. And from among the interesting pieces of money that the old Greeks used, you may be able to obtain one that has the head of Athena on one side, and an olive branch and an owl on the other. If you will look in the big Standard dictionary, under the word "coin," you will see a picture of this old coin.

Why Trees Do Not Have Leaves In Winter?

When fall comes the leaves of all kinds come down, down, down. But fortunately the leaves do not fall from the evergreens, for if this should happen, what would we do for our Christmas trees?

Now, why is that these trees lose all their pretty leaves and are as bare as dead trees all through the long winter? Of course, we like to see the leaves fall. We like to rake them up and jump into piles of them. And they help us to make our flower beds and rosebushes snug and warm for the winter. But all these things do not help the trees themselves any.

The best way to learn why trees lose their leaves when winter comes is to find out what would happen if these trees should keep their leaves through the winter. In the first place, most of the summer leaves are so soft and delicate that the high winds of winter would tear them to pieces. And they are so broad and flat that the heavy snowstorms would weigh them down and break the branches; or the rains might freeze on them and break the branches even more than the snow would. Then too, the ground is usually frozen in winter, so the trees cannot get the water that the leaves need, and if the leaves could not get water they would dry out and wilt.

Now the reason why evergreen trees can keep their leaves in winter is because they are made so that storms and freezing weather do not harm them. The tiny "needles" on all the evergreen trees in the North are so thin and slippery that snow or rain slides right off them. And they are so small and tough that they do not dry out in freezing weather.

If you live in the South you may see many trees and shrubs with broad leaves that stay on all winter. But if you will look at these leaves closely you will see that they too are tough and slippery: so even if it does snow or freeze during winter they will be all ready for it, just as the evergreens of the North are.

What Makes The Bubbles When Water Boils?

Have you ever stood near a kettle of boiling water and watched the water bubbling and dancing about as if it were trying hard to get out of the kettle? Perhaps, when you looked a little closer, you noticed that there were hundreds of little bubbles pouring upward to the surface. And then when they got to the surface they just disappeared.

Let us suppose that you are watching the kettle of boiling water now. If you should get still nearer to it—without getting so near that the steam burns you, of course—you would see where all these lively little bubbles start from. You would find that they all start from the bottom of the kettle, right above the fire or gas flame. Now this is what is happening down there where the bubbles start: After the kettle has been over the heat a few minutes the water begins to get hot. Then, as it gets still hotter, some of it begins to turn into steam. But as the bottom is the hottest place of the whole kettle, the water turns to steam fastest right there. And so much steam forms that it collects in little bubbles. These bubbles are so light that almost as soon as they are formed they suddenly let go and shoot upward to the surface. Then when they reach the surface they break, tumbling the water about and letting the steam that was in them escape into the air.

Do You Know?

How Long It Would Take One Bee To Make A Pound Of Honey?

When you eat a teaspoonful of honey, you probably do not stop to think how hard the bees had to work to make that honey. And it not only took the bees a long time to make the honey, but it took a great many blossoms to supply the bees with the nectar from which the honey is made.

Let us imagine that one bee has decided to make a pound of honey all alone. Of course a bee never would do this, for bees never work alone. There are always hundreds of others working with him. But it will be easier for us to understand how much work it takes to make a pound of honey if we imagine that one bee does it all.

Let us suppose that our bee starts out on the first day of July to make this pound of honey. We will say that each trip of his to the clover field takes just two minutes from the time he leaves the hive until he comes back, deposits the nectar, and is ready to start out again. We will suppose that his hive is right close to the clover field and that he will not have to spend any extra time hunting up flowers. And we will also suppose that he will live much longer than most bees, and that he doesn't need any rest at all between trips or through the night. But even with everything in his favor, he would be a very busy bee, for he would have to visit 62,000 clover blossoms and make 2,750,000 trips to bring in enough nectar to make his pound of honey!

Now if you were to figure out how long it would take him to make all those trips, you would find that he would have to work day and night, week in and week out, for over a year! You see he would have to live in a place where it is summer all the time, for he would have to work all through the summer, the fall, the winter, the spring, and part way through the next summer. If you had to pay that bee as much as you would a person for working all that time, your pound of honey would cost a lot of money, wouldn't it?

That You Can Lift A Heavy Book With Your Breath?

Until you have tried it, you will probably not believe that it is possible to lift a heavy book by merely blowing into a paper bag. Yet you will find that, after you have had a little practice, you will be able to lift not only one book but several of them placed on top of one another until the pile is a foot high.

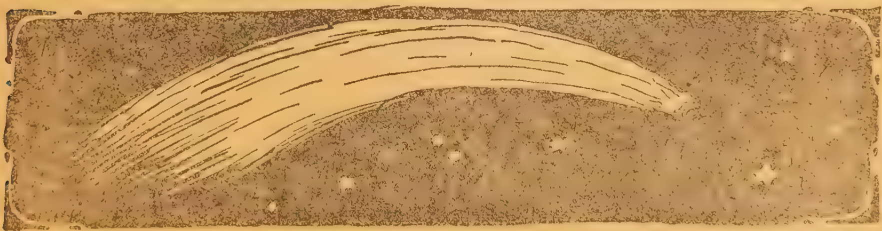
To do this book-lifting stunt, select a rather long, narrow bag that is made of good, strong paper. Lay it down flat on a table so that the open end protrudes about three or four inches beyond the edge of the table. Place a heavy book squarely over the bag. Then bring the open end of the bag together just as you would if you were getting it ready to explode. Now blow into the bag, making sure that it fits your mouth tightly and that all of your breath goes into it. You will be astonished to see how easily the book rises up from the table. Try adding another book, and then another, steadying the pile if it begins to tip to one side.

Where Shooting Stars Come From?

You have probably seen a star shoot suddenly across the sky and then go out, just like a fire ball from a skyrocket. But if you have never seen one, watch sharply some evening when the sky is clear and starry.

When you see your first shooting star, you will probably think, just as I did, that one of the stars that we see every night has become unfastened and dropped to the earth. But this is very, very far from the truth. In the first place, the stars that we see every night are so far away that it would take years for them to get to us. The shooting star is really not a star at all. In fact, if you could see one before it started to "shoot," it would look just like an ordinary stone, and it would probably not be much larger than a kernel of corn or a hen's egg. And you would find that it is cold and that it does not shine at all.

These little stones are floating around in space—thousands and thousands of them. They just drift around, always cold and dark, until finally the earth in its journey around the sun comes near enough to one of them to attract it. You know that anything near the earth will fall onto it.



Well, when one of these little stones gets near the earth it falls toward the earth. That is, it starts to fall. It goes faster and faster through the air. And as it goes it gets hot. Finally it gets so hot that it burns—yes, really burns! Then it is we say we see a shooting star.

If one little shooting star is very small it will probably all burn up before it reaches the surface of the earth. Then it goes out. Most shooting stars do this. Sometimes, though, the stones are large enough to last until they strike the earth. Then we call them meteors. Some day you may see a meteor in a big museum.

Now, the next time you see a shooting star, do not feel sorry that a big star has fallen down and gone out, for no such thing has happened. It is merely a little stone that has burned itself up by rushing swiftly through the air just above the earth.

How Much Wood It Takes To Make A Newspaper?

If you do not know how paper is made, I suppose you are wondering what wood has to do with newspapers. Well, it has a lot to do with them, for it is of wood that most paper is made.

Yes, probably all of the paper upon which you write, and the books from which you study are made from wood. Some writing paper and some books are made from other materials, but most of the paper that you use every day is made from wood.

Let us see just how a tree growing in the forest can be changed into a pile of newspapers that hundreds of persons can read, for that is really what is happening every day. Most of the trees that are used for making paper, grow in the northern woods; and if we were to visit these forests we should see lumbermen selecting and cutting the kind of trees that are needed. If they are getting out wood for making newspapers, they are probably cutting down hemlock, spruce, or balsam trees, for these are the trees from which newspapers are usually made.

After the trees have been cut and hauled to the paper mill, the bark is taken off, and all the knots bored out. Then the logs are cut up into small blocks and put into a machine that cuts these blocks up into chips. The chips are "cooked" in immense kettles, and after that they are pounded up into pulp. It is this white, paste-like pulp from which the paper is made. A quantity of pulp is spread out to dry on a long strip of fine wire screening. After it is nearly dry the strip of pulp is taken out and run through heavy rollers. It now begins to look like paper. A few more things are done to the strip of paper before it is wound up on a big roll and sent to the newspaper printing plant or to other places where paper is being used. If it is going to be made into writing paper for you or paper for your school books, it has a smooth coating put on it so that the ink will not "run."

That is the way paper is made from wood. Of course, there are a great many details in the process that I haven't time to tell you about just now, but I think you probably have a pretty good idea of the principal steps in changing a tree into a strip of paper.

If you had all the paper that one tree would make, you would have a lot of it. But when we think of the enormous amounts of paper used every day for all kinds of things, we can see that a good many trees have to be used to make all this paper. And the newspapers, especially the big city newspapers, use it up faster than any other industry. The Sunday edition of a big city paper requires sixty tons of wood pulp to make all the paper needed for one issue. Now, if we could take all the copies of this Sunday edition, and change them back into growing trees, it would take from one to five acres of forest land to hold all these trees! If they were all fifty-year-old trees they would go on one acre; but that means that it took fifty years' growth on a whole acre of forest land to make enough wood for one day's supply of paper. If the paper makers did not wish to use up the wood faster than it grows, it would take over 5,000 acres to supply the wood necessary for a year's publication of the Sunday edition.

Now, if you live where there are no forests, you will probably think that there cannot possibly be enough trees in the world to make all this paper. But there are still many millions of acres of forests in the northern regions that have plenty of the kinds of trees used for making paper. And of course all these trees are growing and making more wood

each year. So while you are using up paper one year, a million trees way up north are making wood that will be used for the paper that you read from or write upon next year.

Why Owls Can Fly Without Making Any Noise?

You may perhaps think that none of the birds make any noise when they fly anyway. But that is a great mistake. If you were near enough to a crow or a hawk when he is flying, you could hear the "swish, swish" of his wings as he beats the air with them.

But no matter how near you were to an owl when he was flying, you could not hear a sound. You see, an owl has to fly without making any noise, for most of the animals he hunts,—such as mice and rabbits, are timid and have very sharp ears; they could get away from him if they could hear the "swish, swish" of his wings.

The reason other birds' wings make a sound when they beat the air is because the wing feathers are stiff and there is a chance for the air to rush through these stiff hairs. That makes the swishing sound. But the owl's wings are thickly padded with very soft, downy hairs. These prevent the wind from rushing through the stiffer hairs and making a sound that would warn his prey.

Why You Can "See Your Breath" On Cold Days?

The air in your lungs is warm and moist. When you breathe this warm, moist air into the cold air outside, your breath is suddenly cooled, and the moisture condenses into very tiny droplets of water, which float about in front of you until they evaporate again. Thus you really make a little fog or a tiny cloud when you breathe on a cold day, for fogs and clouds are formed in much the same way, only it is the earth itself or the rivers, ponds, lakes, and oceans that do the "breathing."

Do You Know?

Why You Can Swim More Easily In Salt Water Than In Fresh?

If you went to the seashore this summer for the first time, knowing how to swim in fresh water, you were probably astonished at the difference between swimming in fresh water and swimming in salt water. If you could swim but a few feet in fresh water, you were delighted, no doubt, when you jumped into salt water and found that you could swim for a long distance with very little effort.

Now it may be that you are like most persons who go to the seashore for the first time after having learned to swim in fresh water. They usually think it is because they have become more expert in swimming that they can swim so much better. They do not give the ocean any credit at all for making them expert swimmers. But if they go back and try to swim in fresh water again, they realize then that it was not their own skill that made them swim so well, but something that the ocean did for them.

As you probably know, all ocean water contains vast quantities of salt. Besides salt it has a number of other substances dissolved in it, and most of these are heavier than water. So if you were to weigh equal amounts of ocean water and fresh water, you would find that the ocean water weighs more than the fresh water. Consequently,

you do not sink so far into salt water as you do in fresh water, for your body does not weigh as much in proportion to the salt water as it does in proportion to the fresh water. The water in Great Salt Lake, Utah, contains much more salt than ocean water, and because of this it is so heavy that no one can sink in it.

So, the next time you swim in salt water, remember that it is the salt, and not your skill, that holds you up.

How A Toad Drinks?

Now, I suppose you think this is an easy question. "Why, he drinks just like any other animal. He either sips the water like a horse, or laps it up like a cat," you say. But if you will follow that old hop-toad in your garden all summer long, you will not see him drink one drop of water in this way.

How, then, does the toad drink? Certainly he does not drink as you do. In fact, he does not drink through his mouth at all! If you have followed your toad around for several evenings and given up trying to find how he drinks, you have probably seen him drinking a dozen times without knowing it. Perhaps you saw him hop up to a moist spot of earth—under a leaky faucet, or near the watering trough by the barn. Then you probably thought he was just resting. But the truth is, he was drinking—"soaking" rather, for a toad drinks through his skin. He absorbs water from the soil in just about the same way that the roots of a tree absorb it: only, of course, the toad is on the ground, and the roots are in it.

In rainy weather the toad has no trouble in finding a place to "soak," for the ground is moist everywhere. But in very dry weather he may have to travel a long distance to find water.

That Some Mice Can "Telegraph" With Their Toes?

You have probably heard a mouse squeak. Anyway, you know that he does squeak. In fact, house mice have a language of squeaks that they use when they want to talk with one another. But the little white-footed mouse that lives in the woods cannot squeak at all; yet he has a way of signaling to other mice that serves him just as well as the squeaks of the house mouse.

If you were to go into the woods some dark night when everything is very quiet, you would be almost sure to hear two or more white-footed mice "telegraphing" to one another. You would have to listen very carefully though, for the "ticks" are not very loud, and you might mistake them at first for the chirping of insects. To get some idea of how they sound, make several tiny nicks in the edge of a strip of paper, and then draw this nicked edge quickly across the edge of another paper.

Now, let us suppose you have identified these telegraph ticks of the white-footed mice and are listening to two of them as they signal back and forth to each other. If you are near enough and have eyes like a cat or an owl, you will see one of these mice clinging to a stump or tree trunk; and then, if you watch closely, you will see him tap on a loose bit of bark, several times in rapid succession with his toe nails. This is the way he tells the other mice where he is and that there are no enemies about.

How Long Your Tongue Would Be If It Were As Long As A Butterfly's?

If you have ever watched a butterfly close to, you have seen that queer-looking tongue of his, all coiled up like a hairspring in a watch. If he were an accommodating butterfly, he probably uncoiled his tongue and began to sip nectar from the blossoms upon which he was resting. And then, were you careful to notice, after all the coils in that watch-spring tongue of his had been straightened out, how long it was?

Of course you couldn't tell exactly how long his tongue was, but if you could have measured it carefully, you would have found that it was just about as long as his body. Now, if you had a tongue as long as that, it would be at least eighteen inches long, for that is about the length of your body; that is, the trunk of your body is that long.

Why Wood Crackles and Pops When It Burns?

When you sit in front of an open fire, or even before a wood stove, do you ever wonder what makes the wood crackle and snap as if a lot of firecrackers were hidden in it somewhere?

There are no firecrackers in the wood, however. That is, there are none like those that you use on the Fourth of July. But there are thousands of little enclosed spaces all through each stick of wood that really "go off" when the wood is burning. These little spaces or "cells" are filled with air, or with other gases, or with moisture. As the fire burns, it heats the air or moisture in these little spaces. The heated air or moisture expands until there is a great pressure in each space. The pressure in the spaces near the surface finally becomes so great that the thin walls suddenly break, making the crackling sound you have heard so often.

The loud pops and sharp snaps that you hear are usually caused by the explosion of gases in larger spaces. And perhaps you have noticed sometimes, especially if the wood was moist or green, little steam whistles that keep up for almost a minute, shooting out a tiny cloud of steam at the

same time. These are caused by the pressure of the steam in several spaces which are connected. The steam keeps pressing on all sides of the spaces until it finally breaks through a weak spot somewhere, and as it rushes through this tiny hole, it makes a whistling sound, just as you whistle through a little hole made by your lips.

That Horses Were Once As Small As Dogs?

If you had been living in North America three million years ago, you would have seen a little spotted animal, about the size of a modern fox terrior, dashing in and out among the trees of the forest. Looking closely, you would have seen that he had four toes on his front feet and three on his hind feet.

This little animal was the "Eohippus," which means the "earliest horse." If you had seen little Eohippus when he was living, wouldn't it have been pretty hard for you to imagine that three million years later his descendants would be the big, powerful horses that do so much hard work for us? And then, too, whatever has become of all those toes that little Eohippus had, for the horse of to-day, you know, has only one large toe on each foot—and that toe is really his hoof.

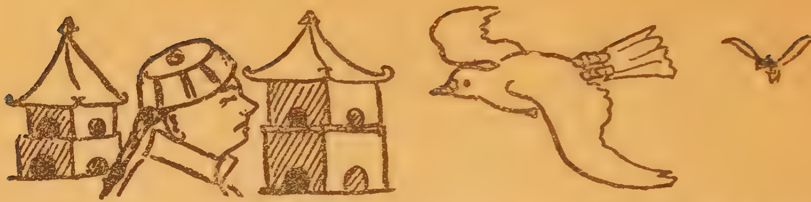
You must not think that all these changes came about at once, for they did not. They were stretched over all those three millions of years. As time went on little Eohippus grew larger; or, rather, his descendants that lived a little later were larger. And as these grew larger, they gradually lost all the toes on each foot—all but one, the middle toe, which developed into the so-called hoof of the horse of to-day. You can see just how this was brought about by placing the tips of your fingers down upon a table. When you have done this, lift the thumb and little finger. This represents little three-toed Eohippus. Next, lift the second and fourth fingers, leaving the middle finger upon the table. Now, if you can imagine all the fingers growing shorter, the middle finger growing larger, and the finger nail growing into a hoof, you will see just how the horse evolved from a three-toed animal to the single-toed or hoofed animal of to-day.

Some day you may have an opportunity to visit the American Museum of Natural History in New York. There you can see models and pictures of all these ancestors of the horse, from little Eohippus up to the big horse that we know so well.

That The Chinese Have Pigeons That Make Music For Their Owners?

Now you must not think that these pigeons make this music by playing a musical instrument themselves. They do nothing more than fly about just as they always do. Yet as they fly, music is continually floating down to their masters on the ground.

You are probably wondering how a pigeon can make music by flying about through the air. But if you could



look closely at one of these pigeons, you would see a queer little musical instrument strapped to the upper side of his tail. It is really nothing more than six or eight light bamboo whistles of different notes. As the pigeon flies rapidly through the air, the wind rushes over the whistles and "blows" them, just as you can make a bottle "whistle" by blowing across the open end.

Sometimes, we are told, a pigeon-owner makes several sets of pigeon whistles, one for each of his pigeons. Each set has a different note, yet so tuned that it sounds well with the others. In this way the Chinese pigeon-owner enjoys a regular free concert, while his pigeons are flying about through the air.

How Long It Would Take You To Count Up To A Billion?

Unless you expect to live until you are a hundred years old, and are willing to give up every bit of your time, you had better not try it.

Now probably you do not believe this; but let us see how it would work out. Suppose you allow one second for each number. That seems easy at first; but when you get into the thousands, it is not so easy; and when you arrive at the million mark, you will find that you will have to talk fast to keep up to your time allowance.

Well, let us suppose that you have decided to count that billion. You start in, say, at seven o'clock Monday morn-

ing. By eight o'clock you will have counted to 3600. Allowing ten hours for your working day, you will have 36,000 to your credit at the end of your first day's work. A pretty good start, you say. But you forget how much a billion really is. You will have to put in a solid six-day week to get up to 216,000, and a solid fifty-two-week year to arrive at a point a little over the eleven-million mark. At this rate, you see, even by keeping constantly at the task, it would take you nearly ninety years!

Why Birds Do Not Fall Off Their Perches?

A great many of our birds, in fact, nearly all of those that we are apt to see about our homes, sleep in trees by holding on to a twig or branch all night long. Now if you should try to sleep in this way you would probably get a bad fall before you were even entirely asleep. You would be all right as long as you were wide awake, but just as soon as you began to get sleepy your fingers would relax, and down you would come.

How is it, then, that a bird manages to stick to his perch all night long, even if the wind blows hard and the branches sway and jerk about continually? The secret of it is that the weight of his body pulls the cords of each toe so tight that the branch is firmly gripped, and he is thus held in this position all night long, locked to the branch by his toes. Then when morning comes, he wakes up and releases his grip on the branch by just giving the muscles of his toes a little pull. As a matter of fact, though, he does all these

things without even thinking of them—just as you and I do a hundred things each day without first stopping to think how to do them.

Why Scotland Chose The Thistle For Her National Emblem?

The people of Scotland did not choose the thistle for their national emblem just because it was a common flower, as you might suppose. The story of its origin goes back many hundreds of years to the time when the Danes had invaded Scotland and were ravaging the land. At least, that is what we are told.

One very dark night, the story goes, a number of Danes were creeping up on an encampment of sleeping Scots. But before they got near enough to start their attack, one of the Danes stepped on a thistle. Now if you have ever stepped on a thistle, or even brushed against one, you can imagine just what that Dane did!

Well, the Dane's cry was enough to arouse the whole encampment of light-sleeping Scots. They hurriedly snatched up their arms and charged upon the invading Danes, completely defeating them. So ever since that night the Scotch people have had a great deal of affection for the prickly thistle. You see, it was really because of that one little thistle plant that the camp of Scots was saved and the foreign invaders driven from the land.

Do You Know?

That An Insect Builds A Little Stone House And Carries It Around With Him?

If you will go to the edge of a brook or the quiet shore of a pond or lake, you may see some little stone housebuilders crawling over the bottom. Even if you cannot find the little housebuilder himself you ought to find some empty houses, for these little insects, the caddis worms, leave their houses behind them when they come out of the water for good.

When you find an empty caddis house, examine it carefully. It is made of a great many tiny pebbles, arranged in the shape of a hollow tube with a large flat pebble closing one end. The caddis worm uses some kind of water-proof cement to fasten the pebbles together. The owner of the house fits snugly into his little tube. When enemies are around he pulls his entire body into his stone house, just as a turtle pulls his head and legs into his shell. Then when he wants to walk about again he puts his head and the forepart of his body out, and walks along dragging his house after him.

A little later in the season, when he has completed the first stage of his growth, he crawls up on to a stem or twig above the water, goes to sleep, and in a few days crawls out of his stone house and flies away as an adult moth.

You may find a number of different kinds of caddis houses, for there are several kinds of caddis flies and each

kind builds a different sort of house according to his own whim, or according to the building material with which he has to work. Some select very tiny pebbles and others use larger ones. Some build their houses of little sticks or bits of grass, especially if there are no pebbles where they live. These houses look like little log cabins. I once knew a man who experimented with some caddis worms in his aquarium. He took away their own stone houses and gave them a number of loose watch jewels. In a few days they had built new houses for themselves from these watch jewels—little jewel houses of shining rubies and sapphires, as pretty and fairy-like as any of which you have ever read.

Why Dogs Turn Around Before They Lie Down?

You may have noticed that when your dog goes to bed he usually turns around two or three times before he finally lies down. Those who have studied dogs tell us that long ages ago when dogs were wild, they lived and slept out of doors. They did not sleep in dens or hollow trees as some animals do, but merely trampled down the long grass or leaves wherever they decided to lie down and sleep.

Our dogs of to-day, of course, do not live and sleep out of doors—at least they do not sleep in the fields and woods as their ancestors did. But even after all these long centuries that dogs have lived with us, they still inherit this trait of

their ancestors. So no matter how well you have made up your dog's bed for him, he still turns round and round, first this way and then that, until he thinks that the bedding is all trampled down as it would be if he were making his bed in the tall grass.


How The Thimble Got Its Name?

Probably every girl reader could answer right off if I asked her which finger she puts her thimble on. And if I told her that thimbles were once worn on the thumb, she would be very much surprised. However, this is so. The first thimble was made in England over two hundred years ago. It was very clumsy and decidedly different in appearance from our neat modern thimbles of silver or aluminum. Because it was worn on the thumb and because it looked like a little bell, it was called a "thumb bell." As the years went by the people who used the thumb bell found that it would be more effective if worn on the middle finger. So after this it was made to fit the finger, but people still spoke of it as a "thumb bell," and gradually the name was shortened to "thimble."

Where Mother Nature Does The Cooking?

How would you like to live in a place where you would never have to chop wood for a fire, or pay for coal or gas to burn in a cooking stove? In several parts of the world, as you perhaps know, there are springs of boiling water. In our own Yellowstone Park, travelers sometimes boil eggs for their lunch by simply leaving them in a pool of hot

water for a few minutes. The story is told that in some places you can catch a trout in a cold brook, and then without moving a step, swing the line around, drop the fish into a hot spring near by, and in a short time your trout will be all cooked.

However, we might not care to cook all our food that way; but the native women of New Zealand find that Mother Nature is a great help to them in their cooking. Their kettles have no bottoms, as ours have. Instead, there is only a network of string or rope. Meat, fish, vegetables, or whatever they wish to cook, are put into these queer kettles, and then they are placed either directly in the water or over a crack in the rocks where steam rushes out. In a short time the food is all boiled or steamed as well as on our most modern range; and the best part of it all is that the heat doesn't cost a penny, and the native woman never has to worry about her fire going out.

Why The Sky Is Blue?

Perhaps when you were younger, you thought that if you could jump high enough, you would "touch the sky." But if you jumped from the earth to the moon, you would touch nothing but air, and very little of that after you got up a few miles. Yet it certainly looks as if there was a blue wall of something up there, doesn't it?

That blue wall must be made of blue air, then, you say. But the air up there really isn't any bluer than it is right

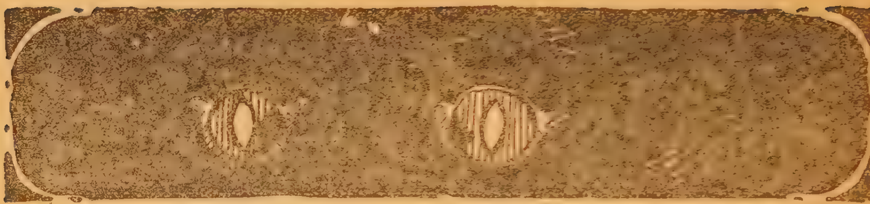
here in our own room. You would find that out if you went up a mile or two in an airplane. The secret of it is that when sunlight is passing through the sky, the air particles break up the colors in the sun's rays and send the blue rays down to us. These blue rays are very, very thin, so thin that we do not notice them at all in a room or in short distances out of doors. If you look at hills or mountains a few miles away, however, they will appear blue. This is because the air between you and the mountains has held back all the colors except the blue rays, and there are enough of these blue rays to make the mountains look blue.

Now if you can imagine a hundred miles of air above you, and if you remember that each part of that vast ocean of air is really sending a very tiny ray of blue to you, you will know why the sky is blue. In the first few miles of air, however, there are not enough blue rays for us to see. Consequently the blue sky looks very far away.

Why A Cat Can See In The Dark?

Have you ever gone into a dark room and been "frightened out of your shoes" by two fiery eyes glaring at you? And then when you switched on the electric light, how astonished you were to learn that it was not a terrible monster after all, but only your own pet pussy cat!

Pussy's eyes do not have lamps in them, however, as you might perhaps believe. She does have an arrangement,



though, by which she gathers together what few light rays there are at night, ànd reflects them out again, just as a reflector in a bull's eye lantern or an automobile headlight gathers the light rays of its own lamp together and throws them out so that they light up one spot. Her eyes can open very, very wide, even in the daytime, as you may have noticed when she is in a dark corner. So, you see, she can gather and use every bit of light there is. You may wonder how there can be any light in a room that is dark, but there is always a little bit, and pussy is able to use tiny rays that we cannot see at all. And if it is so very, very dark that she does not have even these tiny rays, she can always guide herself around by her whiskers, which she uses as "feelers."

Pussy uses her "night eyes" in finding her way about at night and in lighting up a mouse hole in a dark corner.

That Mice Live In Old Birds' Nests?

If you have noticed an empty bird's nest, half filled with snow and swaying about in the cold north wind, you will probably wonder why a family of mice should ever select such a place for their winter home. But the little white-footed mouse has found a way to make the most unattractive open nest into a snug, warm, and weatherproof house.

What a queer place for a mouse to live, you say. Well, perhaps if you could take a peek into White-foot's little retreat on a snowy day in February, you might not think it

such a queer house, after all. White-foot has learned to do what most birds cannot do. He builds a roof to his house—a real, tight, snowproof and windproof roof. Late in the fall, when the days are getting cold, he selects some well-built bird's nest for the main part of his house. This saves him a lot of work. Then he carefully builds his roof, weaving twigs, grass, bark, and leaves into a well-shaped dome, and leaving a little door at one side. When the roof is completed to his satisfaction, he looks about for the softest and most comfortable materials that he knows of, and then lines the old nest with this bedding, making as cozy a house as you would wish.

That Chinese Messengers Have A Queer Alarm Clock?

If you are one of those boys or girls who dislike being awakened by the loud ringing of an American alarm clock, I am sure that you would never complain again if you had to be awakened the Chinese messenger's way.

Most Chinamen of the poorer classes cannot afford an alarm clock to wake them up at the necessary hour for duty, and probably they would not know how to use one anyway. However, it has been their custom for centuries to use a long piece of punk which will take a certain number of hours to burn. If a messenger wishes to wake up at five

o'clock, say, he selects a piece that he knows will burn that time. Then he lights one end and puts the other end between his toes. When five o'clock comes the punk has burned down to his toes. Then he wakes up! And there is no danger that he will sleep through the alarm, as you may often do.

How Fast The Wind Moves?

March is the month of high winds. How often you have had to hold on tightly to your hat while the March wind went rushing by you, swirling last year's leaves or stray papers high in the air?

Have you ever wondered just how fast the wind is traveling when it is blowing so hard, or if the wind ever goes slowly enough for you to win in a race with it?

Well, let us imagine that our strong March wind has calmed down so that it blows hardly enough to call it a wind —so slight that you can just feel it on your cheek. You could easily beat it then, even by walking, for it is traveling only about three or four miles an hour. Now if it starts to blow a little harder again, so that you can see the twigs on the trees moving a little, you will have to run to keep up with it, for it is going about six or seven miles an hour.

Let us suppose that this wind is constantly blowing faster and faster. When you see the branches of trees beginning to sway slightly, you will have to get on your bicycle to catch the wind, for it is then going about fifteen miles an

hour. When the larger branches begin to move around, you must get into an automobile, for the wind is then going about twenty-five miles an hour.

Now let us imagine that our wind is a real March wind, blowing sticks along the ground and leaves in the air. You will have to speed up your automobile to forty or fifty miles an hour to catch this wind. Or if you can imagine the wind blowing harder than this—so hard, in fact, that signs are torn loose and chimneys blown down—you will have to leave your automobile and jump on to a fast express train to catch it, for it is now going from sixty to seventy miles an hour.

It is only rarely, however, that you would have a chance to chase a seventy-mile wind. And it would be rarer still if a real hurricane should give you a chance to race it. But if it did, you would have to get into an airplane to catch up with it, for the wind in a hurricane travels almost one hundred miles an hour.

How "Uncle Sam" Got His Name?

You have often seen pictures of Uncle Sam, and perhaps you have dressed yourself up to represent him. You always think of Uncle Sam as just a "make-believe" person representing the United States. But do you know that he was once a real person; that is, the man for whom he was named was real?

During the War of 1812 our government employed a man whose name was Samuel Wilson, but who was always called "Uncle Sam" by those who knew him. His work was to inspect goods that were to be used for the war. If he found that these goods were all right, he stamped them with the initials of the contractor who supplied the goods, also with the initials "U. S." for United States. When asked once what all those initials meant, he jokingly said that they stood for the contractor and for "Uncle Sam." Ever since then the people have spoken of the United States as "Uncle Sam."

That Some Birds Wear Snowshoes In Winter?

You must not think that these birds buy snowshoes and strap them on their feet when they go out for a walk. No, it is quite the opposite—snowshoes grow on their feet.

The ruffed grouse, sometimes called the partridge, lives where the winter snows are usually quite deep. As he walks on the ground most of the time, he needs something to keep him from sinking too deeply into the snow. In the summer his toes are just like those of any other bird, but as winter approaches, a little fringe of stiff hairs grows out on each side of every toe. By the time the first snowstorm arrives, these hairs have grown enough to form a network that is quite as effective in holding him up as a real pair of tiny snowshoes would be. Mr. Grouse wears his snowshoes all winter; then when spring comes, the little hairs drop off, and he goes barefooted again all through the summer months.

Do You Know?

What Becomes Of Insects In Winter?

If you will do a little investigating some day in January, you will be astonished to learn how many insects are safely stowed away in cozy little nooks and corners, waiting for spring to come.

Almost any dead tree with loose bark or spongy wood is a regular free lodging house for insects in winter time. If you should remove the bark or dig into the wood a little, you would be likely to uncover spiders, flies, mosquitoes, beetles, or other kinds of sleeping insects. A Boston museum once mounted some bears in a big glass case. An old tree stump, taken from the woods in late fall, was placed in the case with the bears. Later, when the heat was turned on in the room, the sleeping insects in the stump began to wake up, the insect eggs to hatch, and cocoons to open. Within a few weeks there were swarms of insects, representing many species, flying around inside the case,—all from that one stump. The insect man in the museum spent several hours collecting, sorting, and labeling these insects. He says that it was the first time he had ever been on a collecting trip in winter, and without even going out of doors to catch his insects!

Trees are not the only places, though, where insects spend the winter. Many crawl into crevices in the rocks, and many burrow into the ground. Old barns and sheds shelter all kinds of winter insects. If you live in the country, you might be able to find, in the corners of an old barn or wagon shed, some of the butterflies that live over winter. If you bring them in the house where it is warm, they will

wake up and fly about, as they often do out of doors in the middle of a warm, sunny day in January.

One butterfly, the Monarch or Milkweed butterfly, apparently believes that it is more fashionable to go south for the winter than to spend it sleeping in a cold northern barn. He does not come back in the spring, however. Instead, it is probably his grandchildren, or even great-grandchildren, that will make their way north next summer; for butterflies do not live long enough to make the long trip there and back.

A visit to your attic may reveal several kinds of insects sharing your house with you during the winter, especially if one of the windows was left open last fall. Spiders, wasps, and flies are very fond of an attic as a winter resort.

How Nature Keeps On Trying?

Nature does not give up easily. Plants don't get the "blues," and become discouraged, as persons often do. No matter what difficulties they have to contend with, they keep on trying. The grass that is trampled down every day tries to repair itself and sends out its roots a little further and makes every effort to live. If it is destroyed over a certain area, it begins pushing back into that area at once. In some parts of our country there are many abandoned farms. Here Nature is taking up the work that she was doing before the land was cleared. She is sowing it with seeds of trees, shrubs, and wild plants; and if she is not interrupted again there will soon be a wild forest here, just as there was before man interfered with her work.

Here in the crevice of a rock, on the river bank, a little cedar tree is growing. In some way it has worked its roots down through the narrow space to where it can get food and moisture, and it grows there year after year. If you were to try to raise a tree upon such a place the chances are you would fail. Well, Nature failed, too, at first, perhaps a thousand times. Season after season a seed fell into the crevice and sprouted, but it couldn't get a foothold; finally, however, a seed did get a foothold, and there is the little cedar defying all the world.

If you keep your eyes open out of doors, you will see how Nature wins by sticking to it and making the most of every situation. Watch the persistent spider when her web is brushed away time after time; see how the ants build up their nests again and again after being trodden down by careless passers-by. That is the way of the outdoor world, and it is only by these patient, persistent efforts that Nature's creatures manage to survive.

That the Electric Locomotive Wins In A Tug Of War?

A test was recently conducted at Erie, Pennsylvania, in the presence of 150 leading railway executives of the country, who had been invited to watch the experiment of pitting a gearless electric locomotive against two steam locomotives.

Two modern steam engines of the latest type were switched to a spur, where the electric locomotive awaited them. It was a case of a "double header" against a lone opponent. The "double header" and the electric locomotive were coupled together, facing each other. Engineers of all three had been instructed in their signals; the opposing forces were to be driven against each other. At a given signal from the supervisor the steam engines got under way and began shoving the electric ahead of them along the track; then the current was gradually turned on the electric, while the engineers of both steam locomotives opened their throttles to the last notch.

The watching crowd was astonished to see the steam engines slowly but surely lose momentum and finally come to a complete stop, still with their throttles wide, puffing and chugging under the great strain. Then a big cheer went up from the crowd as it saw the steam engines slowly begin to be forced steadily backward. At first the backward motion was very slow, but gradually, as the full power of the electric engine was brought into play, the steam locomotives moved backward faster and faster. The test was ended a few minutes later and the electric locomotive was declared the victor.

That Windmills Are Being Used In The Sahara Desert?

You are probably wondering what possible use a windmill could have in the Sahara Desert. There is nothing there but sand and hot sunshine, you say. You must remember that people do live on the edge of the desert, where there is a little rain. The rainwater quickly soaks down into the dry soil, however, so that nothing grows very well, except near the springs.

The Arab has had a hard time of it in the past, trying to raise enough food to keep himself alive. But lately European and American engineers have found a way of turning the desert into a rich and prosperous land. They have driven deep wells, far enough below the surface to find plenty of underground water. Then they set up American windmills—just like those you see everywhere in this country—and these pump the water up to the surface, where it is made to flow in little ditches, supplying to the soil all that it needs to make everything grow vigorously under the hot tropical sun. Thus windmills are being used in the Sahara Desert for just the opposite purpose that they are used in Holland. The desert hasn't enough water and Holland has too much; so the windmills bring it to the desert, and pump it away from the low places in Holland.

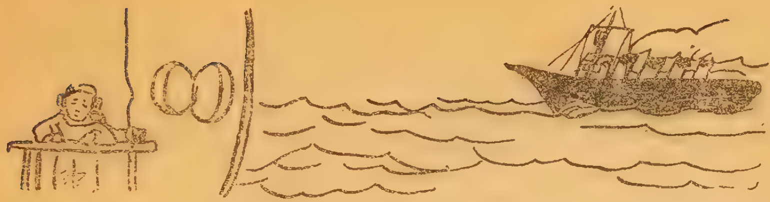
Where Your Pearl Buttons Come From?

The pearl buttons that you wear every day were once part of the shell of a fresh-water clam that lived, perhaps, at the bottom of the Mississippi River. You may have no-

ticed some of these empty clam shells on the shore of a river or pond. One side of the shell is dark and rough, but the other side is white and smooth. These clams are collected by the thousands, and the shells taken to the button factories. Machines cut out the little circles, polish the backs, and bore holes for the thread. Then the completed buttons are sewed to a little card and sent to the stores; and eventually they find their way to someone's clothes.

That Indians Made Stone Saws?

In certain portions of California, Indian relic collectors have found a number of long pieces of stone with one or both edges chipped to form sharp teeth. It is thought these must have been used as saws, because of their shape and because nearly all of them are made of black obsidian, one of the hardest rocks known, and one which is capable of forming a very sharp edge; in fact, obsidian is often called "volcanic glass," and you know what a sharp edge glass has when it is broken. You can easily imagine what a difficult task it must have been for an Indian to make these saws with the primitive tools he possessed.



That Ships Can Now Be Guided By Signals Sent Under Water?

In a series of tests made with ships of the Navy it has been found that, through the invention of the hydrophone, signals may now be sent under water for more than forty miles. It is not only possible for a ship equipped with this new device to tell its exact distance from land, but the presence of other ships may be detected in plenty of time to avoid collision, and even the depth of the water may be measured.

The story of the invention of the hydrophone is very interesting. A sailor on one of our battleships was using a hose on part of the deck, when by accident the nozzle fell overboard and jerked the other end of the hose loose from the standpipe. Hearing a peculiar noise in the tube, he took up the loose end and listened. He could plainly hear the rush of water about the ship. Then he heard a new sound, and looking up, he saw that far in the distance another ship was passing; then he realized that he was listening to the thrashing of her propellors. Upon this little accidental discovery inventors worked and soon completed the hydrophone, which was one of the most useful devices in our navy during the world war.

How The Spectacled Bear Got His Name?

This specimen of the rare South American spectacled bear has been mounted at the American Museum of Natural

History. It is the first specimen of its kind ever secured by the museum.

This bear does not wear spectacles, as you might suppose from his name; but he does have large, grayish-white ring-like markings circling his eyes; and it is these which give him the very droll appearance of wearing huge, light-colored goggles.

He is really a small bear. He measures only three or four feet in length when full grown. The fur is short and stiff, the head is broad, and the body arched. He is black in color. Many believe him to be a near relative of our North American black bear.

Very little is known of the spectacled bear's habits, for he lives in seclusion in the most inaccessible parts of the Peruvian Andes. Scientists have therefore had very little opportunity to study him in his native haunt.

That Insects Are Eaten As Food?

In some parts of the world primitive people can still be found who eat various insects with apparent relish.

Many Arabs are fond of locusts. These are dried, ground to powder, mixed with water and made into cakes; or this powder is salted, cooked and put into sacks, out of which they take large handfuls when hungry. Our Western Indians used to make famous feasts when locusts were plenti-

ful. A traveler who had the courage to try roasted locusts says that he found them very good eating.

Some of the Australian natives who still live primitively, eat almost every kind of animal food. They pick grubs out of rotten wood and cook them in red-hot ashes. They roast grasshoppers and locusts and eat ants. Probably there is as much dirt as ants but that does not bother them. Other ant-eating people are found in the forests of Brazil. The Indians there have been seen to poke a stick into an ant hill and let the ants run up into their mouths! An entomologist who experimented in the edibility of ants says that they have an extremely sour or acid taste.

To us the idea of eating ants seems very distasteful, but what would you say if you had a dish of roasted spiders placed before you? Yet these are eaten by natives of New Caledonia. Huge poisonous-looking fellows are roasted and greedily devoured.

Butterflies do not escape being eaten in some localities. One gorgeous species is a special favorite. The wings are burned off, then the bodies are smoked and pounded into "butterfly meal."

That A New Type of Lighthouse Sends A Beam Visible For One Hundred Miles?

If you should stand on the shore of the ocean you could see a ship on the horizon when it was about eleven miles

away. If it were much further off, you could not see it, owing to the curvature of the earth. Our highest and best lighthouses, however, can send a beam of light that is visible to a ship about twenty to twenty-five miles from shore. But twenty-five miles is about the limit of the old horizontal beam lighthouse. The new type does not try to send its beams directly to the ship; they are sent straight up into the air by a powerful searchlight. The beam of light is thus visible much farther from shore. Even when the sky is cloudy and the clouds are comparatively low, the light can be seen at a distance of fifty miles; and when the air is clear it can be seen a hundred miles away. The beam is given a circular motion or it is "flashed," just as in the old type; and just as the older lighthouses identify themselves by their particular code of flashes, so each lighthouse of the new type has its own distinct code. Thus a ship coming in from an ocean voyage can tell the exact location of a certain lighthouse much sooner by the new system than by the old.

Do You Know?

How Rocks Are Made?

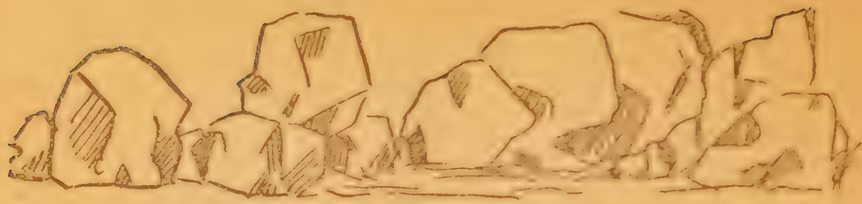
I can't tell you the whole story of the way rocks are made, for it is a very long story and I would not have room to tell it all. I do want you to know the main part of the story, though; for when I was your age, I used to wonder and wonder where they came from, and I would have been very glad if I could have found out then.

Let me say first of all that rocks do not grow. That is, they do not grow the way you may think they grow. Some of them "grow" by being built up gradually, but they never were alive.

There are two principal ways rocks are made. One is by the cooling of molten rock materials that come from far down in the interior of the earth; and the other, strange as it may seem, is the building up of layer after layer of rock in the sea.

Let us first find out something about those rocks that are made from the molten material within the earth. When this material comes out on the surface we call it "lava." That is easy to understand. But much of this material never reaches the surface; it only fills big cracks or caverns far below the surface. The farther down this material finally cools off, the coarser the crystals in the rock will be. Most of you probably know what granite looks like. Well, granite was made by this molten material cooling off far down below the surface.

Now about the other rocks—the sandstones, slates, and limestones that were formed in the sea. They make up most



of the rocks that appear on the surface of the earth to-day. How were rocks, that are now on land, made in the sea? To answer that question, we must first understand that all of the materials that the rivers carry down into the ocean—the sand, clay, and mud—have to go somewhere, and that "somewhere" is the bottom of the sea. Layer after layer of this mud, sand, and clay were dropped on the ocean floor in the ages past, until sometimes these layers were thousands of feet thick. All that weight of materials was enough to press the lower layers together into solid rock. Then at some time the ocean floor underneath these layers began slowly rising, until, many years afterward, it came out of the water and formed land.

So, you see, all the rocks that are on the surface to-day were at one time, probably many thousands or millions of years ago—either molten, or were nothing but sand, mud, clay, or other loose materials. The rocks made in the sea were raised up to the level you now see them, and the rocks that were cooled far below the surface are on the surface now because all the materials above them have since been washed away.

Of course, you understand that all the loose boulders, small rocks, and pebbles are only pieces that have been broken off of the ledges that stick up above the land: and also you probably know that all the sand or gravel that makes up the "land" is only ledge rock that has been all broken up into fine particles.

That Airplanes Help in Power Development Work?

Since the war the airplane has advanced beyond the experimental stage and is being put to new uses almost every day. One of its latest tasks is to help the big power development companies in establishing and maintaining their vast systems in the remote mountain regions of the West. These power development companies, as you perhaps know, are harnessing the wild mountain streams and forcing them to turn dynamos which create and send electric power to cities hundreds of miles away. Now you may perhaps wonder what an airplane can do to help in such work. Well, in the first place, it is being used to transport men and light pieces of machinery to otherwise inaccessible regions. In this way it can be a great help in opening up roads so that the heavier machinery and materials can be hauled to the spot where they are needed. Then, after the system is all installed and the transmission lines are carrying their power over the mountains, the airplane is used to patrol the whole vast system. If a fire starts in any of the wooded sections, it is reported at once to headquarters; or if anything is wrong with the lines, a "trouble hunter" is almost sure to spot it sooner from an airplane that he could by examining the line foot by foot on the ground.

That Houses Are Being Built On The Tops Of Tall Office Buildings?

In New York, where all ground space is extremely limited and residences are constantly being crowded out by new

business blocks, it is becoming the custom to utilize the broad space on the top of tall office buildings for private residences. As you probably know, the roofs of many of these buildings are from 150 to 300 feet above the street and are quite large in area. An ordinary-sized house built on these roofs leaves ample room for the "grounds." It has been found that the air up there is much better than down in the street; it is cool and fresh; there is no dust or dirt; and being so far above the street, it is comparatively quiet, especially after business hours. Some of these building top "estates" are very elaborate. Besides the roomy house, with its broad veranda overlooking the country for miles around, there are gardens, privet hedges, fountains, and in some cases even young trees. After a hot day in his office, the business man has only to step into an elevator and be whirled up to his home, where he has almost all the advantages of a country place on a high hilltop.

That You Can Tell the Temperature By the Songs of Insects?

I have told you that you could tell the temperature by counting the number of times a cricket chirped in a minute. Do you remember how to do it? Well, if you have forgotten it, it doesn't matter much, for it is really easier to look

at a thermometer, isn't it? But the important thing to remember is that all insects chirp faster on a hot day or night than they do on a cool one.

Of course, if insects sing faster on a hot day than on a cool day, it is natural to suppose that they move faster also. And this is so.

I will not try to tell you just how fast the different insects walk on a hot day and how fast the same insects walk on a cool day, for I haven't room enough. But let us see what a high temperature does for an ant. Ants are always moving—at least you very seldom see one still, no matter what the temperature is.

Well, a man once made some experiments with ants on hot days and on cool days, and this is what he found. On a roasting hot day, when the temperature stood at one hundred degrees, and when you probably wouldn't feel like moving at all, this man found that an ant would walk twelve times as fast as he would on a day when the temperature stood at fifty degrees. Just think what that means! Let us suppose that you moved twelve times as fast on a July day as on an October or November day. Ordinarily a person walks at a rate of three or four miles an hour. Let us make it three to be on the safe side. And let us suppose that this is your October gait. Now, if you were speeded up with the temperature, as the ant is, you would be flying around in July and August at the rate of thirty-six miles an hour! It is a good thing that you are not like an ant, for that would be hot work, wouldn't it?

When "Five-Cent Bills" Were Used?

Of course you know what a dollar bill is, and probably you have seen many five-dollar bills, too. But I wonder if you have ever seen a five-cent bill?

If you had lived in the Northern States during the Civil War, you would have seen many five-cent bills; for they were used every day then. And you would also have used ten-cent bills, fifteen-cent bills, twenty-five cent bills, and fifty-cent bills. The people often called these paper bills "shinplasters."

It would probably seem very strange to you, to have to give a paper bill to the storekeeper for a nickel's worth of candy and not get any change back. But some of the money they used then would seem stranger still. What would you think of carrying around a pocketful of long metal strips for money? Those strips were used to encase postage stamps, and each strip was valued according to the number of stamps it held. If you had a one-cent stamp, your strip was worth one cent, and you could buy a cent's worth of candy with it. Or if there were five two-cent stamps in the strip, you could buy ten cents' worth, and so on.

The reason all these small paper bills and stamp strips were used instead of regular silver money was that gold and silver were so scarce at that time that not much of it could be used for actual money.

Why Some Flames Are Yellow And Some Blue?

Of course you have seen both yellow flames and blue flames. A candle flame or a kerosene-oil lamp flame is yellow, and the flames of a gas stove or blue-flame oil stove are blue.

What makes these flames have such different colors? Is it because kerosene oil always makes a yellow flame and gas a blue flame? No, that is not it, for a blue-flame oil stove burns kerosene, and if you have ever seen an old-fashioned open flame gas light you know that gas sometimes burns with a yellow light. And again, if you know what a Bunsen burner is, you know that just by turning a little ring at the base of the burner you can change a blue flame to a yellow flame or a yellow flame to a blue one. That proves, you see, that it is not what is burned that makes the two different colors.

It is the way a thing is burned that makes a flame yellow or blue. You know that nothing can burn unless it has air to burn in, and the more air there is the better anything burns. That is really what happens whenever you see a blue flame. It is getting more air than a yellow flame gets. The burners on a gas stove and on a blue-flame oil stove have little openings at the base where air gets in. And by turning the little ring on the Bunsen burner, you let air in to make a blue flame and shut it out to make a yellow flame.

Now this is what air does when it makes a flame blue. When anything burns, there are always millions of very

tiny particles of carbon in the flame. These particles come from whatever is being burned,—candle wax, kerosene, gas, wood. When the flame burns without any extra air, the particles of carbon are only heated to a yellow heat, just as you have seen iron heated until it gave off a yellow light. But when you let air into the base of the burner, so that it mixes with the flame, this extra air is enough to make the particles burn up entirely. Then you see only the blue color of the burning gases that make up the rest of the material in flames.

You can prove that a yellow flame has unburned carbon particles in it by holding a cold spoon just over a candle flame. In a minute or two the spoon will be black with soot. You can't collect this soot over a blue flame.

That The First Stringed Musical Instrument Was A Savage's Bow?

If you could put on a pair of magic glasses or have some way of seeing everything that happened during the many thousands of years that it has taken from the time when no one was civilized until the present time, when almost everyone is civilized, you would see that nearly every musical instrument that we have to-day can tell an interesting story that continues through all these long ages.

Perhaps the most interesting story of all would be the one that tells how such stringed instruments as the mandolin, guitar, harp, and the piano were developed from the primitive bow that the savage warrior used for hunting and fighting. This story begins soon after the savages learned how to make bows and arrows. They probably found that by picking the strings of their bows, or by striking them with a stick or piece of bone, they could get a pleasing sound

from them. Afterwards they tied hollow gourds to the bow and found that the notes were çlearer-toned and louder. This was the first step toward a real musical instrument, for the gourd acted as a sounding board, and you know that all stringed instruments must have a sounding board.

It was probably many, many thousands of years before this primitive bow instrument of the savage began to develop into the stringed instruments that we are familiar with. Even those that the early civilized people made were very different from anything that we have to-day. But gradually each one began to look a little more like those we know. Those like the violin, mandolin, and the guitar have probably not changed much for many years. But the piano has gone further than any of the others; and, just as the stringed instruments have a more interesting story to tell than any other group of instruments, so the piano has a more interesting story than any of the other stringed instruments.

This is about the way the piano developed from the savage's bow to the beautiful upright or grand piano of to-day: The first step was probably two or three strings of different lengths tied tightly to a curved piece of wood. Then, slowly—but very slowly—this instrument came to have the shape and appearance of the harp that was used so much during the middle ages. The next great step was the harpsichord, which is the direct ancestor of our piano.

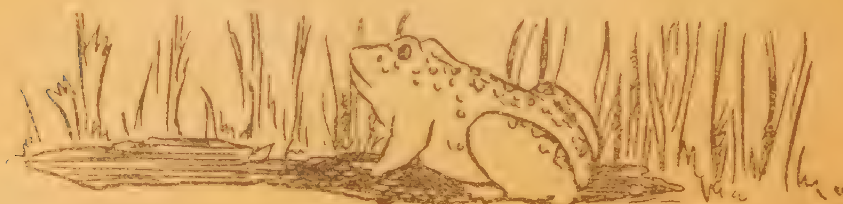
And before many years had passed, the first piano appeared —not much like the ones you know, but a real piano just the same.

So, strange as it may seem to you, when you take up your mandolin or violin or sit down to play the piano, you are really playing upon an instrument that has grown through thousands of years from a primitive savage's bow.

How Far Away We Could Hear A Frog Peep If He Were As Large As A Man?

If you have never seen a "spring peeper," the little frog that peeps so loud from every marsh and pond edge during early spring, you would be astonished to learn how tiny he really is. The peep of one of these little frogs can easily be heard a half a mile away. You might suppose that a frog that could be heard a half a mile away would have to be a pretty big frog. But the truth is, our little spring peeper is hardly more than an inch long!

Now you know that if you were to try to imitate the peep of a frog, you would have to try very hard to peep loud enough to be heard that distance. Even if you had a whistle that was as large or even larger than the little frog itself it would have to be a good whistle to send a note a half a mile. And of course you yourself are many, many times as large as the little spring peeper.



Let us suppose that you could peep just as well as this little frog; or perhaps I had better say, let us imagine a spring peeper as large as you. He would of course be many times as large as he really is, and his peep also would be many times as loud. Men who have made a study of these little frogs say that if they were really as large as we are, their peeps would then be deafening shrieks that could be heard twenty miles away! Now perhaps it is best after all that these little frogs are only an inch long, for if they were all as large as we are, there would be so much noise everywhere in the country during early spring that we could not hear one another talk. In fact, if there were a pond or marsh anywhere within several miles of us, the noise would be so loud each night that we could never get to sleep.

Why A Woodpecker Can Pound So Hard With His Head?

You have probably seen a woodpecker or a flicker hammering away with his bill on a tree trunk or branch. Now wood, you know, is quite hard; and if you were to use your head to hammer a bill against a piece of wood, your head would feel rather sore after a few blows, wouldn't it? How then, is the woodpecker able to hammer so hard and so long without hammering his head to pieces?

If a woodpecker's head were made like most other birds' heads he couldn't hammer so hard. But he has a very efficient "shock absorber" between his skull and his bill. Just where the base of the bill is attached to the skull there is a

thick piece of gristle that absorbs all the jar of the hardest blow. So, you see, a woodpecker doesn't mind hammering his bill with his head any more than you mind hammering a nail with a hammer.

What "Pieces Of Eight" Are?

No doubt all of you have read Stevenson's "Treasure Island." Of course, if you have, you remember old Captain Flint's parrot, who was always shrieking out, "Pieces of Eight, Pieces of Eight!" Probably you puzzled over these "pieces of eight" just as much as I did, the first time I read the story.

Now what the parrot meant when he shouted these words to everybody was not eight pieces of something, but an old Spanish coin, or "piece" of money, having a big figure eight on it. This coin was the famous old Spanish dollar, that circulated when pirates and treasure seekers roved over the seas.

A "piece of eight" was a rather large silver coin, about the same size as our silver dollar. The big figure eight meant eight reales; that is, it took eight reales to make the Spanish dollar, just as it takes one hundred cents or four "quarters" to make our dollar.

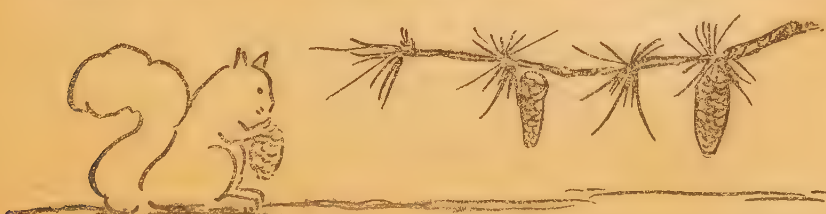
On one side of a piece of eight were two pillars, called the "Pillars of Hercules." These pillars represented the

Straits of Gibraltar, which at the time the coin was designed were looked upon as the "end of the world." You know that before Columbus discovered America many people thought that there was nothing but water beyond the Cape of Gibraltar. No one—not even Columbus—dreamed that a whole new continent lay at the other side of this ocean. So when the coin was designed, these words were placed over the Pillars of Hercules: Ne plus ultra (Nothing more beyond). But when Columbus proved that there was something beyond Gibraltar, they took off the ne, and made the words read Plus ultra (More beyond).

It may interest you to know that the English sailors, who never could remember what word the figure eight stood for, often called the coin an eight bit piece, or "eight bits," and that is where we get our modern slang expression, a "two-bit piece," which as you probably know, means a "quarter." You see, four "quarters," or "two-bit" pieces, make 'eight bits," or a dollar.

How Squirrels Get The Seeds Out Of A Pine Cone?

If you were given a tight pine cone and told to get all of the seeds out of it with only your hands and teeth, you would probably give up before you had succeeded in getting even one seed out. Or else you would break off some of your teeth on the hard edges of the cone. At least you would get your mouth sore and all stuck up with pitch.



Now if you were a squirrel instead of a boy or girl, you would know just how to get these seeds out, and you wouldn't break off your teeth, or get your mouth sore or covered with pitch, either. There is a little trick about unlocking this tight pine cone that the squirrel knows all about. It is really no more trouble for him to get the seeds out of a pine cone than it is for you to get a peanut out of its shell.

The reason the squirrel can get the seeds out of a cone so easily is because he knows just how a cone is made and where the weakest places are. He takes the cone in his paws, and instead of trying to bite right through the tough sticky side, as you might do, he turns the cone bottom up and gnaws through each scale at the base where it joins the core or stem. This is the thinnest part of the scale, and a little nip of his sharp teeth here cuts the whole scale right off. Just underneath each scale he finds a loose seed, which he immediately snaps up and eats. Then he goes to the next scale, nips it off at the base, and picks up the seed that is underneath it. Round and round he twirls the cone in his paws, while his busy teeth cut one after another of the scales. In a short time he reaches the tip of the cone, and so comes to the end of his meal of pine seeds. All that is left of the cone now is a little pile of scales and the long tough core.

How Much You Would Weigh If You Lived On The Moon?

I suppose you think that no matter where you go, you would weigh just the same at one place as at another. Well, that is true for all places on the earth. But if you could visit the moon you would find that you wouldn't weigh the same at all.

Let us suppose that you really weigh just ninety-six

pounds. That is, you weigh that much on the earth. But as soon as you reached the moon, you would find that you weigh only sixteen pounds there! That, you see, is only one-sixth of what you weigh on the earth. And the queerest thing of all is that you would not only weigh just one-sixth of what you do on the earth, but you could jump six times as far as you can on earth! If you can jump over a fence three feet high, you could jump over a fence eighteen feet high on the moon, without any more effort. And you would also be able to lift six times as much as you can on the earth.

Let us find out why things are so much different on the moon. In the first place, we must remember that it is gravity that makes weight. Gravity, you know, is just the attraction or "pull" that the earth has for everything on it. The bigger you are, or the more "solid" you are, the more the earth will try to pull you. And the more the earth pulls, the more you weigh. It is because the earth is so large and so compact that it pulls hard enough to make you weigh ninety-six pounds.

Now the moon, as you may perhaps know, is about one-fourth the size of the earth, but it is not so compact or dense as the earth; so it can pull only about one-sixth as much. That is the reason you would weigh only one-sixth as much as you do on the earth. And now you can understand the reason you could jump six times higher if you were living

on the moon than you can here on earth. Of course, if the moon can pull only one-sixth as much as the earth, it will be able to hold you back only one-sixth as much when you jump, and consequently you would be able to jump six times farther.

That is what would happen if you went to the moon. But let us suppose that you could go to Jupiter, the largest of the planets. Then instead of weighing only sixteen pounds, as you would on the moon, you would weigh two hundred forty pounds! But on the other hand, you could jump only about ten inches high! That is because Jupiter pulls about two and a half times as much as the earth. Jupiter is really over a thousand times as large as the earth, but it is not nearly so dense or "solid."

That A Watch Goes Differently On Different Persons?

If you own a good watch, I hope that you take good care of it; for a well-made watch is really a very delicate piece of machinery. And like any other delicate machinery, if you don't take good care of it, it won't run well.

Perhaps you think that you do take good care of your watch. You wind it every night, and are careful not to drop it on the floor, or even to hit it against anything. But do you know that if your watch simply falls to the end of the chain, or if you put it down suddenly, or even make a sudden movement yourself while the watch is in your pocket or on your wrist, it is likely to affect some part of the movement?

Let us suppose that you have a good watch and that you take perfect care of it. Perhaps you have been to the jeweler to have it regulated and it now keeps perfect time. But if you were to let someone else take your watch and carry it for a while, you might be astonished to find out that while your friend has it, it runs either slower or faster than it did while you had it. Jewelers know this, and that is why, to get your watch to run perfectly, they have to regulate it while you wear it. They say that it is almost impossible to find two persons who use the same watch who do not have to have it adjusted to each one of them.

Not only are good watches so delicate that they run differently on different persons; but some of them are so delicately adjusted that they run differently on automobiles or on railroad trains! Locomotive engineers, who of course have to have as accurate watches as it is possible to have, sometimes find that a watch that keeps perfect time while it is being carried on one locomotive will either gain or lose if its owner changes over to another locomotive.

So, you see, there is much more in getting a watch to keep perfect time than just winding it regularly and keeping it from dropping on the floor.

Where Fish Poles Are Eaten?

Most fish poles, you know, are made of bamboo. Sometimes the bamboo is "split" and glued to make a fine-grade fish pole. But the cheapest fish pole is usually made of a whole bamboo "tree," just as it grows.

Now, of course, if you were to try to eat one of these fish poles, you would have a hard time of it; and perhaps you would break off one of your teeth before you had much of

it eaten. "How then," you say, "can a fish pole be eaten, and who wants to eat one anyway?"

Well, no one wants to eat a full grown fish pole any more than he would care to eat a full-grown asparagus stalk that has been cut and dried. And right there is the secret. Bamboo fish poles have to start growing as a tiny stalk, just as any other single-stemmed plant has to do. When the young bamboo shoot pokes its head above ground it looks very much like an asparagus shoot just starting up. It is then that the little bamboo stem is cut off, cooked, and eaten. And people who have eaten it, say that it is almost as tender as an asparagus tip.

I guess you will have to be content with using bamboo fish poles to fish with; for you will never be able to find one growing so that you can cook it and eat it. That is, you can't unless you make a visit to the warm countries where bamboo grows abundantly. If you ever go to the Philippine Islands or to any other tropical land, you may have an opportunity to eat fish poles on toast.

How To Make The Sunrise Last All Day Long?

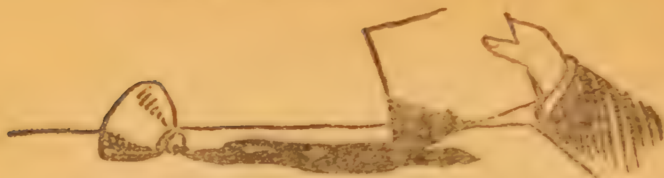
That sounds impossible, doesn't it? Well, perhaps it is, at least it is if you want the sunrise to last all day long in one place. But if you could travel fast enough, you would be able to make it stay sunrise, or make it stay any other part of the day, as long a time as you care to have it.

You probably know that the earth spins entirely around

on its axis once in twenty-four hours. It turns from west to east, and that is what makes the sun look as if it travels through the sky from east to west. So if you want to keep the sun from rising, you will have to travel in a westward direction just as fast as the earth is traveling from west to east.

Of course, you could never do this by running, or by riding in an automobile. Not even the fastest airplane made could do it. But let us imagine that we have a big, powerful airplane that will go many times faster than the fastest airplane now built. And let us suppose that, just as the sun is about to rise, we start off in this airplane and head directly west. Away we go, over cities, forests, mountains, plains, and lakes. The hands on our watch move around to seven, eight, nine o'clock; yet the sun is not any higher than it was at six o'clock. It is in exactly the same place as it was when we started. There it stays all day long—only this doesn't seem like a day at all, but just one long sunrise. Even when the watch tells us that it ought to be midnight, it is still early morning by the sun.

When it is six o'clock by the watch again we slow down and stop, just where we started from. We have had twenty-four hours of sunrise, but we had to go completely around the earth to get it. Or we might say that we have stayed up in the air for twenty-four hours while the earth turned completely around underneath us!



That If You Lived In A Desert You Wouldn't Need A Blotter?

I suppose that you have used a blotter so many times that you never stop to think just what the blotter does when you use it, or why you have to use it at all. But you know that if you didn't use a blotter, you would have to wait a few moments before you could fold over your paper. And if it were a rainy day, or if the air in your room were at all damp, you would have to wait a still longer time for the ink to dry.

The reason the ink takes so long to dry on a wet day is that there is so much moisture already in the air that it takes a long time for the water in the ink to evaporate; and ink, you know, is made up mostly of water. Even on days that we call "dry," there is always some moisture in the air—not much perhaps, but enough to prevent the ink from drying quickly. That is the real reason why we use blotters. A blotter does not dry the ink, but it absorbs all the ink that does not stick to the paper. And this ink that sticks to the paper does not rub off, of course.

Now you can see that if there were no moisture in the air to prevent the ink from drying, we would not need blotters; for the ink would be dry before we had time to reach for a blotter and use it. Well, that is what would happen if you lived in a desert, where there is almost no moisture in the air. Everything dries very rapidly in a desert, because the dry air absorbs water quickly. If you should fall into a pond or stream there, you would not have to go home and change into a dry set of clothes, because your clothes would

dry off almost before you could take them off. But you would have to be very careful not to catch cold, for the rapid evaporation would take the heat from your body and make you chilly. A man once told me that he caught the worst cold he ever had right in Sahara Desert when the temperature was over 100 degrees.

How Long It Takes A Clock To Tick A Million Times?

Have you ever listened to an old "grandfather's clock" as it goes tick-tock, tick-tock, so slowly that you sometimes wonder if the next tick will ever come? If you have, that clock was probably ticking seconds. Perhaps you counted each tick and found that there were just sixty ticks in one minute. And perhaps you wondered how long it would take you to count a million of these ticks.

Let us suppose that you have decided to count a million ticks of the old, grandfather clock. Even though you can count off sixty ticks every minute, you will have to sit beside the clock for a long time before you reach the millionth tick. In fact, you can't do it at all unless you don't mind losing several nights' sleep.

But let us suppose that you are determined to do it, and that you have arranged to have your meals brought to you, and also that you have someone that will take the "night shift" for you. We will say that you begin at six o'clock Monday morning. By six o'clock Tuesday morning you will have 86,400 ticks counted off. By six o'clock on the next Monday morning you will have 604,800 to your credit. Now,

you see, you have not much more than half the amount counted off. So you will have to keep on counting all through Monday, Tuesday, Wednesday, and Thursday of this second week. When six o'clock on Friday evening comes, you will be close to the million mark. Then—if you have counted correctly—just before the clock gets ready to strike eight, you will hear the millionth second ticked off.

It has taken you one week, four days, and almost fourteen hours to count these million seconds. That seems a pretty long time, doesn't it? The next time that one of your friends tells you that it took him "a million hours" to do something, ask him if he knows how long a time a million hours is. Tell him how long a time a million seconds is. Next, tell him to think how much longer an hour is than a second. Then tell him this: "If it took you a million hours to do that, you must be more than a hundred and fourteen years old, for that is how long a million hours is!"

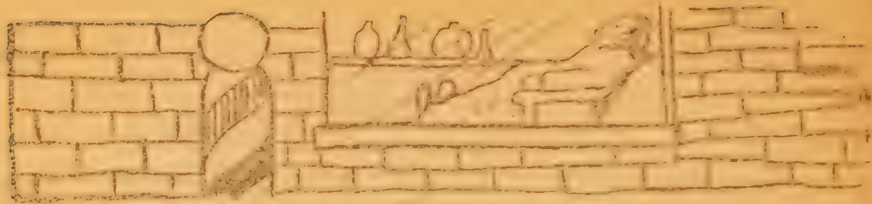
Do You Know?

Why A Barber's Pole Is Striped?

Wherever you see a barber's shop, you see in front of it a pole with stripes on it. The stripes are sometimes red and white, sometimes black and white, and sometimes red, white, and blue. The pole itself is not always a real pole. It may be a large round pillar, or it may even be nothing more than a flat board. But the stripes are always there. Have you ever stopped to think what these stripes have to do with haircutting or shaving and why a barber always puts them outside so that everyone will know that he is a barber?

Well, as a matter of fact, those stripes haven't anything to do with haircutting or shaving. Why, then, does a barber use them? To answer this question we will have to go back to the time when the barber was something more than just a person who cuts hair and shaves men. That was the time—many, many years ago, when people knew very little about sickness and how to cure it. When a person had anything the matter with him, he believed that the best cure was to let himself bleed a little. That probably seems to you a very strange thing to do. Well, it was, but the people did not know anything better to do then.

At that time it was the custom for anyone when he wanted to be bled to go,—not to the doctor or the surgeon as he would to-day, but to the barber! Now this, too, probably seems very strange to you; but it wouldn't if you had lived at that time.



Let us suppose that a patient has come into one of these old barber shops to be bled. He bares his arm, walks up to the barber's pole (which is now inside the shop) and grasps it tightly with his hand to hold his arm in a rigid position. The barber gets out his knife, makes a small cut on the patient's arm, and lets it bleed a while. Then when the barber thinks it has bled enough, he takes a long strip of bandaging cloth, and winds it tightly about the arm to stop the bleeding. The patient pays the barber and goes out. After he has gone, the barber puts this pole outside his shop again to let people know that he bleeds people. I forgot to tell you that even at that time the barber's pole was striped. But these stripes really meant something then. They represented the bandages that the barber wound around his patient's arm.

What Direction The Compass Points To At The North Pole?

I once heard Commodore Peary ask a large audience of boys and girls if any one among them could answer this question, and none of them could! As I was one of those children, of course I could not answer it either. Now, I would have given almost anything if I could have answered

him correctly. And that is the reason I want you to know the correct answer, so that if a great explorer ever asks you this question, you will be able to tell him right off.

There are two or three things that you must know before you can answer the question correctly. The most important of these is that there are two north poles—the north geographic pole, and the north magnetic pole. Of course you know that the geographic pole is not a real pole sticking out of the earth to mark the most northern spot on the earth, as you probably used to think when you were younger. The north pole,—and when we say the north pole, we usually mean the north geographic pole—the north pole, then, is nothing more than the place where the earth's axis cuts the surface; or in other words, it is the one spot on the northern hemisphere that stays still while the rest of the earth turns about it,—just as the very center of the point of a spinning top stays still while the rest of the top spins around.

Well, we seem to be getting rather far away from the answer to our question; but, then, you must know all these facts before you do answer it. The next thing to know is that the compass doesn't point to the north geographic pole, but to the north magnetic pole. And this magnetic pole is over nine hundred miles away from the geographic pole. If you will look at the map of North America and find Bothia Peninsula, way up near the Arctic Ocean, and north of Hudson Bay in Canada; and then if you will find King William Island, just west of Bothia Peninsula, you will have a pretty good idea of where the north magnetic pole is. As a matter of fact, no one knows exactly where it is;

but it is somewhere in the ice-covered sea between Bothia Peninsula and King William Island. If you have an old map, it may give the magnetic pole as on the land of Bothia Peninsula. But explorers have found that it is not on the land, but in the sea west of the land.

Now I think you can easily see that, as the Gulf of Bothia is south of the north geographic pole, if you were standing on the north geographic pole, your compass would point south. But if you stood right over the magnetic pole, and if you had a compass that swings up and down instead of from side to side, your compass would point directly downwards.

Another thing the magnetic pole does by being so far away from the "true" north, as we call the direction to the geographic pole, is to make almost all of the compass directions in the United States point a little to one side of the "true" north. If you live in the Central states, your compass will probably point to the "true" north, because—as you will see if you look at the map—the geographic pole, the magnetic pole, and the place where you live are all in one straight line. But if you live in the far Eastern states, your compass will point a little to the west of "true" north; and if you live in the far Western states, your compass will point to the east of "true" north.

What Makes Fog?

If you have ever been in a fog, you know that the air feels damp where the fog is. Well, it is damp, and the reason it is damp is that fog is made up of millions and millions of

very, very tiny particles of water that are so light they float in the air. These little particles are so small that if you were to place them side by side, it would take from 2000 to 3000 of them to make a row an inch long!

I suppose you would like to know where these little particles of water come from. That is rather a long story, for they get there in a number of different ways. First of all, you probably know that whenever water evaporates, or dries up, it turns into water vapor. We cannot see this water vapor, any more than we can see the air that it is a part of. Water vapor is being made wherever water is exposed to the air. It comes from the oceans, lakes, rivers, and ponds; from the ground; and from trees and other plants. In fact, water vapor is pouring into the air all the time, and the warmer the air, the more water vapor it can hold.

Now whenever this warm air comes in contact with cold air, the water vapor in the warm air condenses and turns back into a liquid again. The particles of water that form are so very, very tiny that they do not even fall to the ground. But there are so very many of them, and they are so close together that they can be seen, and it is all these millions of particles floating around in the air that make the fog.

The fogs that you see at the seashore are usually formed when the warm, moist air that is over the ocean, blows over the cooler land. The fogs that you see over ponds and lakes are made after dark, when the air above the water is cooler than the water itself, so that when the warm, moist air rises up from the water, it strikes the cooler air above, and

a little fog is formed. And right here let me tell you something very interesting about these little fogs that we see in valleys and over ponds and meadows. It often happens that each one of these fog particles forms around a very tiny bit of dust in the air. And it is these dust particles that help the fog to form, for they give the cooling water vapor a convenient place to start condensing. It is said that the heavy fogs of London are partly due to these dust particles that are thick in the air over the city. The warm, moist air from the Gulf Stream blows over the land and commences to cool. Then when it comes to the smoky air about London, it immediately condenses on these little floating dust particles, and a heavy fog settles down over the city.

Why Silver And Gold Coins Have A Rough Edge?

If you will look at a dime, a quarter, or a half dollar, you will notice that each coin has a lot of little grooves running across the edge. Be sure to get a coin that is not worn down much, because the worn coins do not show this very well. If you happen to have a gold piece, you will see that it, also, has these little grooves on the edge.

This rough edge is called a "milled" edge. After you have examined a few silver coins to make sure that you know what a "milled" edge is, look at a cent and then at a nickel. You do not find any milling on these coins, even on the very newest of them, do you? Perhaps you think that this milling is just a decoration. But there is a much more important reason for it than that. Silver and gold, you know, are valuable metals, and the milling is put on the edge of these coins as a protection. If the milling were not there, it would be very easy for a dishonest person to file off a little silver or gold from the edge of a coin without

changing the appearance of the coin. And he could keep on filing a little silver or gold from every coin that passed through his hands until he had stolen a large amount of these precious metals from the government without being detected. Now if any one were to attempt to file off even a very little silver or gold from the edge of a milled coin, it would show that it had been tampered with, and just as soon as he tried to pass this coin he would be arrested. Consequently no one dares to tamper with a milled coin.

If you have a collection of old coins, you will notice that each one of the silver coins in your collection has some kind of rough edge. It may be milled, like our present coins, it may have little raised olive leaves, or it may have a phrase or sentence, in raised letters along the edge. But the object is always the same—to keep any one from stealing any of the silver in the coin.

You may be wondering by this time why nickels and cents are not milled. When you stop to think of it, the reason is very plain. The metal in either of these two coins is not considered valuable enough to tempt any one to try to steal any of it, and so there is no need of a milled edge.

Why A Chicken Holds Up His Head When He Drinks?

When you drink a glass of water, you keep your mouth to the edge of the glass. Even when you lie down flat on your stomach and drink from a spring, you do not have to lift up your head at each mouthful, as a chicken does.

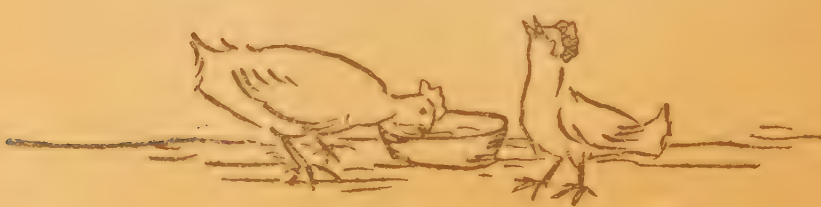
I suppose it looks very queer to you to see a chicken do this, and you probably wonder why he cannot keep his bill

in the water and suck it in, as you do. Well, he just can't do it, and the reason he can't, is because he is not made the same way you are.

Most birds do not have as good a set of muscles in their cheeks as you do. Consequently they are not able to suck in the water and to get it started down their throats. So they have to dip their bills into the water, catch up a bill full, and then lift their heads up so that the water will run down their throats.

If you have ever kept pigeons, or if you have watched them drink, you probably noticed that they do not lift up their heads when they drink. That is because their cheek muscles are more flexible than most other birds, and they can suck in the water just as you do.

I suppose you are wondering why chickens and other birds do not have to hold their heads up when they eat. Well, birds get their food started down their throats just as we do—with their tongues. When a chicken pecks at a piece of corn, he gets the corn on the end of his tongue, and carries it back in his mouth to his throat; and in this way he gets it started down without lifting his head. Of course you know that when either food or water gets started in our throat, the throat muscles take care of it the rest of the way. And birds' throats are built just about like ours.



Do You Know?

What Makes Leaves Fall?

I have told you why leaves fall from the trees and stay off all winter. Now I am going to tell you just how they do it.

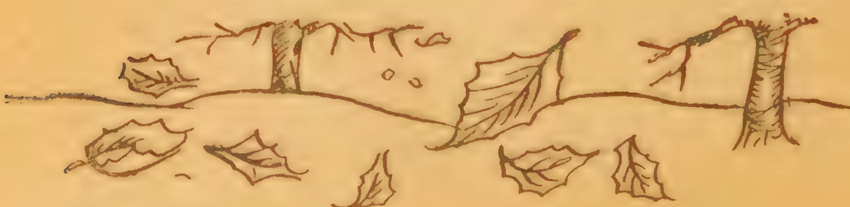
You know that leaves stick to the trees pretty well all summer long, even during high winds. Yet when autumn comes, the least breeze sends them flying to the ground. And sometimes they come down when there is no breeze at all. What is it that makes them fall off so easily at this season?

There are a good many things going on inside a leaf that you cannot see just by looking at the outside of it. All summer long it is working hard for the trees; but when fall comes, there is no more work for it to do; so the tree drops it.

Now this dropping of the leaf is not such a sudden process as it seems to be. In fact, it is often several weeks between the time that the tree starts preparations for dropping it, and the time that it actually falls. When autumn approaches, two separate layers of corky material start to form across the inside of the stem near the end where the leaf is attached to the twig. This does two things,—it cuts off the stem, and seals up the ends. But even after these two layers have formed all the way across the stem and have left a tiny space between, the leaf does not fall. This

is because in every leaf stem there is one or more little hollow threads that carry water and plant foods to and from the leaf. These little threads or "bundles" as they are called, are very tough. The layers of corky material extend from the outside of the stem to these bundles, but there they stop. It is these tiny threads that hold the leaf on after most of the stem has become separated from the twig.

The final step in dropping the leaf is the breaking of these little threads. This is done in two ways. A slight breeze blows the leaf and twists the threads until they finally break, just as you sometimes twist a wire around until it breaks. The other way is by the action of frost. Water, you know, expands when it freezes. When a frosty night comes along, a tiny bit of ice forms in the space between the two corky layers. It doesn't expand much, of course, but it is just enough to break off the little threads that hold the leaf. Then, in the morning, just as soon as the sun strikes the tree, the little layer of ice melts, and as there is nothing now to hold the leaf on, down it comes. This explains why it is that on a still morning after a frost you often see leaves come tumbling down in showers just as soon as the sun starts to climb up above the horizon.



How Tapioca Was Discovered?

The tapioca that we buy at the grocery store, comes, as you know, in little, round, white pellets. But it does not grow this way. It is made by boiling the roots of a bushy plant that grows in the tropical regions of South America. The starch from the roots is skimmed off and dropped onto hot iron plates, which form this starchy paste into the little pellets with which you are familiar.

Now, I am sure that most of you will agree with me that tapioca pudding is about as delicious as anything you ever ate. But there was a time when no one would touch tapioca, for everyone believed that it was deadly poisonous. Well, it was poisonous, and whenever anyone tried to eat it, he at once became very sick. That is the reason why for many, many years people knew about tapioca, but they never ate it. How, then, could such a poisonous food ever become fit to eat? To answer this question, I will have to tell you a little story that happened a number of years ago.

An explorer was lost in the tropical forests of South America; so the story goes. He wandered around for days and days, becoming hungrier and weaker every day. Finally, he gave up all hope of being able to find his way out of the forest, and sat down to think what he should do. He

knew from the natives that the cassava root (from which tapioca is made) is poisonous; so he made up his mind to gather a number of these roots and eat them. He thought that he would rather die quickly by poison than to starve to death slowly. As he was very, very hungry, he decided that for his last meal he would have a good feast, anyway. He accordingly got out his cooking utensils, built a fire, and boiled up all the cassava roots that he could get into his little kettle. Then he ate the whole thing with great relish: but instead of dying within a few hours, as he had expected, he grew stronger and stronger, and by the next day he found his way out of the forest and told the world how to make tapioca!

So, you see, tapioca was discovered by accident; and if it had not been for that explorer, lost in the South American forest, we might never have known how good tapioca pudding really is.

Now some of you may think that the tapioca that you get at the store might be poisonous. But you need never be afraid of this, for all the tapioca that you buy is first cooked; and the whole secret of making tapioca fit to eat is that cooking destroys every bit of poison that was in it when it was growing.

That A Baby Bird Eats More Than Ten Times As Much As You Do?

Of course, a baby bird doesn't actually eat very much compared with what you eat. If you should place the food that a baby bird eats in one day beside the food that you eat in one day, your pile would be much larger.

But in proportion, a baby bird eats much more than you could possibly eat,—without dying from the effects of eating so much! A bird grows up much faster than you do. Within a few weeks after he has been hatched out of the egg, he has tried out his wings and left the nest. Now the parent birds have to work very hard to keep him supplied with food enough to take care of such rapid growth. All day long, every day, the parents bring him food as fast as they can find it and bring it back to the nest. Those who have studied very carefully the amount of food that birds eat have found that if a person were to try to eat as much in one day in proportion to what a baby bird eats, he would have to eat nearly seventy pounds of meat and drink a lot of water besides! And that, you see, would be impossible for anyone to do.

Why A Dog Barks At The Moon?

Perhaps it would have been better if I had asked you why a dog barks on moonlight nights, instead of at the moon, for he doesn't really bark at the moon, as most persons think he does. It is true that he looks as if he were barking at the moon, but that is only because he usually points

his nose up into the air when he barks on these bright, moonlight nights.

Dogs do many queer things that seem very hard for us to understand until we study the ways of wolves, which are very near relatives of dogs. In fact, we are pretty sure that many, many years ago all dogs were just about like the wolves of to-day. So when we study the habits of the wild wolves, we are quite sure to find an explanation of many of our dogs' habits.

To find out why a dog "barks at the moon," therefore, let us first suppose that it is a clear, moonlight night and that two or three dogs in different parts of the neighborhood are barking or howling at the tops of their voices. Then, if you can, try to imagine that these are not dogs but wolves that are barking and howling, and that instead of a civilized neighborhood you are in the midst of a vast forest There is one wolf right near you. He lifts his nose high in the air and howls. Soon another wolf answers, and another, and another. After several minutes these other wolves begin to join the first wolf, each one howling all the time. Then, finally, after fifteen or twenty wolves have congregated, they all start off through the forest, howling and barking as they go.

Now this is what happened: When the old leader of the pack (which was the wolf near you) saw the bright moonlight shining through the forest, he knew that it would be a good night for hunting; so he howled as loud as he could to let the other wolves know that there would be a hunt that night Each of the other wolves answered him, and each one kept barking and howling so that they could all come together as quickly as possible.

This may all seem to you as if it had nothing to do with your civilized dog barking in your back yard; but it has. When he came out of the house in the evening and saw the bright moonlight shining, something reminded him of the far off days when his ancestors were wolves, and he lifted his nose up in the air and began to bark and howl. Of course, your dog didn't know it, but he was doing just what his wolf ancestors would have done on a similar night.

How A Grasshopper Can Hold On To A Slippery Grass Stem?

Have you ever watched a grasshopper as he jumps from one plant to another plant three or four feet away? He gives a sudden spring and goes sailing through the air; then—click—he lands right on the side of a slippery stem. Once in a great while he loses his hold and drops to ground, but usually he sticks just where he landed. Sometimes you may even see him walking easily up the side of a smooth, slender, grass stem.

If you were to look at a grasshopper's leg through a magnifying glass, you would understand how he can stop himself so quickly, and how he can climb up a slippery grass stem so easily. You would see on the end of his foot a little hook that is just about large enough to curve around the side of a small stem. This hook helps him stop after he lands and helps to keep him from falling to the ground. You would also see a number of short sharp spines on the side of his leg. These spines all point downward; that is, from the grasshopper's "knee" to his "foot."

To get a better idea of how these little spines help the grasshopper in climbing up a smooth stem, let us turn to one of man's inventions, which is really an imitation of the grasshopper's set of spines. You have all seen a telephone lineman climbing up the side of a smooth telephone pole. He is able to do this because he has a set of "climbing irons." Now each of these climbing irons, you know, has a stout, sharp spur on one side, and the lineman is able to climb up the pole by jabbing first one spur into the pole and then the other. Well, the grasshopper really has a set of "climbing irons" too, only his are not made of iron, and he never has to put them on or take them off, as the lineman does.

Do You Know?

That Umbrellas Were Once Used Only By Women?

You are so used to seeing everyone with umbrellas,—men and boys as well as women and girls,—that it may seem very strange to you that once no one but women ever thought of carrying umbrellas. But if you had been a boy or man a hundred and fifty years ago, you would no more have thought of using an umbrella to keep the rain off you than you would think of using a sunshade to keep the sun off you to-day.

Mentioning sunshades reminds me that umbrellas were once used to keep the sun off as well as the rain. In fact, the very name umbrella means a "shade maker." We know this because the word for shade in the old Latin language is umbra. Now you are probably wondering why a thing that is now used only on days when there is nothing but shade anyway should be called a shade maker. But let's go back a few thousand years and read the story of the umbrella. Then you will probably understand the whole thing a little better.

No one knows who used the first umbrella. As far back as we can go, we find that the old kings in Egypt, China, and India used them. But in those far-off days no one but members of a royal family dared to use one. Many centuries later, when the Greeks and Romans were the most powerful people in the world, women, as well as members

of royal families, carried them. At that time they were used mostly as sunshades, for these countries were hot and very sunny. It was about this time, or a little later, that the name umbrella was given to them. Several centuries later still, we find them in England; but here, instead of being used mostly to keep the bright sun off, they were used mostly to keep the rain off. And here, as in Greece and Rome, it was the women only who used them. It was not until about 1750 that men and boys began to carry them. The story is told that the first man that had the courage to use an umbrella was a London man, and that the first time he carried it, a mob of boys followed him all over the city, making all sorts of fun of him for being afraid to get wet!

When it was found how useful umbrellas were to keep off the rain, they were finally used for that purpose only; and a separate, lighter kind of umbrella, the sunshade that we know today, began to be used for keeping the sun off. But the old name umbrella still clung to the first kind, and that is why we call it a "shade maker" when it isn't used to make shade at all.

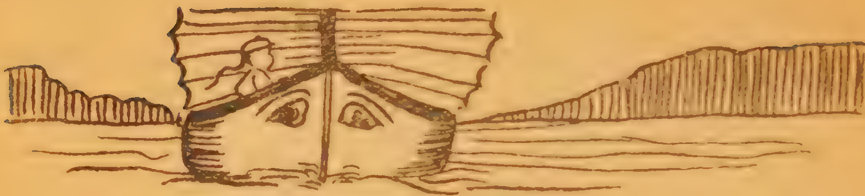
How The Dandelion Got Its Name?

You probably think, just as I used to do when I was your age, that the word dandelion means "dandy lion." But it doesn't mean exactly this, although the "lion" part is all right, for it really has something to do with the word "lion."

If you will look at a dandelion leaf, you will see that along each edge is a row of "teeth" that all slant the same way. Now when people commenced to study plants and to think up names for them, they looked at this leaf, and somehow all these slanting teeth reminded them of a "lion's" teeth. So they called this little plant, that has such a pretty yellow blossom, a word that means "teeth of a lion," although they did not say it this way. The word that they used was "dent-de-lyon." This was taken from the French words "dent de lyon," which mean teeth of a lion. You know that the dentist is the man that repairs your teeth. Well, he is called a dentist because "dens" or "dent" means teeth. So you see it is easy for you to remember why these people first called the dandelion "dent-de-lyon." It wasn't long, however, before this name became changed. People began pronouncing it dant-de-lyon, and finally they left the "t" out, changed the "y" to "i" and it became dandelion, as we know it today.

That Some Boats Have Eyes?

You mustn't think that these eyes are real eyes, for they are not. They are only painted eyes. But why, you ask, should boats have eyes painted on them?



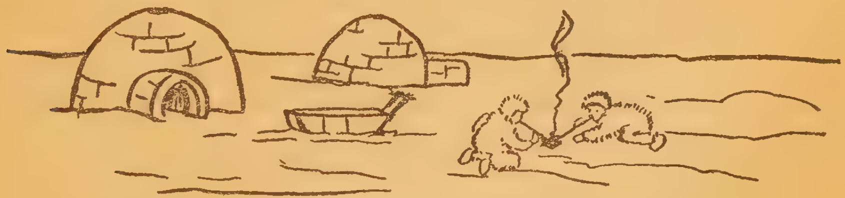
To find the answer to that question you will have to go way around to the other side of the world—to China. And even when you get there, you will have to search a long time before you can find a boat with eyes, for they are found only in those places where the old, old customs are still kept up.

If you should succeed in finding a boat with a big, staring eye painted on either side of the bow, and then if you were to ask its owner what the eyes were for, he would tell you that they help the boat to see its way over the water. And the owner is very, very careful that nothing is hung over the side of the boat in front of one of the eyes for he really believes that if the boat's eyes are covered up it cannot see its way as it moves along.

That Eskimos Use Reindeer Bones As We Use Soda Straws?

Fresh water is very scarce in the Arctic regions in the winter time. The Eskimo is usually obliged to melt snow or ice to get it. When an Eskimo is going on a long journey, in order to save time in melting snow, he fills a skin bag with snow and wears it next to his body. The heat from his body melts the snow as he walks along. Then when he wants a drink of water it is all ready for him.

Sometimes, when several Eskimos are thirsty, they chip out a hollow in the ice and build a little fire of dry moss on a raised platform of old bones or rocks which they have placed in the center of the hollow. The heat from the fire melts the surrounding ice a little, and the water runs down into the bottom of the hollow. Each one of the Eskimos then sucks up his share of the water through a hollow reindeer bone, just as we drink soda through straws.



How The Daisy Got Its Name?

The daisy, that you know so well, has been known for hundreds and hundreds of years. Children probably "told their fortunes" by it two or three hundred years ago, just as you do to-day.

The people in England were so familiar with the bright-eyed little field daisy that they gave it a name over a thousand years ago, when the Anglo-Saxons ruled England. But I am afraid that the name that they gave it then would look rather queer to you. They called it the "daiseyghe." Now this word was made up of two Anglo-Saxon words, "daeges" and "eage," and these words mean "day's eye." The Anglo-Saxons called this little flower the "day's eye" for two reasons. First, it reminded them of the bright yellow sun with its rays of white light. And then they also noticed, just as you may perhaps have done, that the little white "rays" close up at night and open out again in the

morning. So the name "daieseyghe" was really a very good one to give to the daisy, even if it has such a queer appearance.

Of course you know that names become changed after hundreds of years have gone by; and so the word "daieseyghe" gradually changed to "daysesye," then to "dayse," and finally to daisy, as we know it to-day.

How Ants Talk To One Another?

Now you mustn't think that if you sat down near an ant nest, you could hear a conversation going on among the ants, for you wouldn't hear anything. Ants do not talk with their mouths as we do; they talk with their feelers. They have a language of "rubs" instead of a language of words.

Those who have studied ants say that they seem to make one another understand perfectly when they are "talking" this way. No one has ever been able actually to learn this language, but it is certain that just by this rubbing and stroking, an ant can tell another ant where to find food or that an enemy army of ants is coming, he can ask him to come and help him do some important work, or a hundred other things.

Let us imagine that we are seated near an ant nest, so that we can watch one of these "conversations" closely. Here is an ant that is walking slowly about over the rough ground. And there comes another ant hurrying along so

fast that he tumbles headlong over sticks and stones. He dashes up to the first ant and with one of his feelers quickly rubs one of the first ant's feelers a few times, and gives him a pat or two on the back. Then the two start off quickly in the direction that the second ant came from. Let's follow them. Oh, here is what all the fuss is about,—a dead caterpillar! Evidently the second ant had found it, and it was too heavy for him to drag; so he went for help. Perhaps his rubs meant, "Say, Bill, I've found a big fat caterpillar for the colony, but he is too heavy for me." Then perhaps those pats that he added meant, "Come on; help me,—that's a good fellow."

Now probably the first ant's name wasn't Bill; perhaps he didn't have any name. And probably the second ant told the whole thing in a very much different way. But anyway, the first ant understood what was said (or rather, "rubbed"), and that was all that was necessary.

How Much Water A Plant Uses During A Hot Summer Day?

You know, of course, that every plant must have water, or it will die. Perhaps some of the plants in your garden this year wilted and died because there was not rain enough or because you did not water them yourself.

All plants take water in through the roots and evaporate it out through the leaves. And they take in and give out a surprising amount each day, especially on a hot day. The

reason plants use more water on a hot day than on a cool day is this: Most of the leaves on every plant are exposed to the hot sunlight all day long. Now if the water in these leaves should stay there all this time, it would get so hot that the delicate materials inside each leaf would be injured. So the leaves open wide every one of the thousands of little breathing holes that are on the under sides of each leaf, and the water turns to vapor and rushes out into the air. Then more water comes up from the roots to take the place of the water that has evaporated out through the leaves. In this way the water never stays in the leaf long enough to get very hot.

If you could see all this water vapor that pours out from every plant all day long, you would realize what large quantities of water the plant must take in through the roots. Some men have made a study of this and have been able to estimate just how much plants do take in and evaporate. They have found that one sunflower plant, for example, evaporates more than a pint of water on a hot summer day, and that an acre of vegetable plants uses, during a single growing season, almost a thousand tons of water!

Do You Know?

Why We Tell Lady-Bird To Fly Away Home?

When you say

Lady-bird, lady-bird;
  Fly away home!
Your house is on fire;
  Your children will burn—

do you ever stop to think what kind of a house Lady-bird has, and why her children are so apt to burn up?

Now perhaps you don't call her lady-bird at all. Perhaps you call her lady-bug, as I used to do. But to tell the truth, she is neither a bird nor a bug, but a beetle. Her real name is lady-beetle. Well, anyway, let's call her lady-bird, for that is what she is called in the rhyme.

Perhaps I had better tell you first how lady-bird got her name. That happened many, many centuries ago, during the Middle Ages. At that time lady-birds were called, "beetles of Our Lady." Then gradually they were called lady-beetles, lady-birds, or lady-bugs.

Lady-bird's children (or larvae, as the insect men call them) are very fond of the little, green aphids, or plant lice, that are found so much on garden plants. In fact, they eat almost nothing else. So wherever you find a lot of aphids, you are pretty sure to find some of lady-bird's children.

When the little rhyme about lady-bird was written, it was the custom in Europe to burn all the hop vines at the end of the growing season. These hop vines usually had a number of aphids that had been living on them during the summer. Now the vines, you see, were the houses that lady-bird's children lived in, and it was because the children were often burned up along with the aphids that we tell lady-bird to hurry home.

Of course, you know that a lady-bird cannot understand what you say to her, and even if she did, she could not do much to save her children. But neither can Baa-Baa Black Sheep tell you how much wool he will give you, nor a cat play a fiddle while a cow jumps over the moon.

Why Cows Chew Their Cuds?

Have you ever watched a cow while she "chews her cud"? She lies quietly in the shade and chews, chews, chews for a half hour or more at a time. Yet during all of this time, she doesn't get up or even snatch another mouthful from the grass about her. What does she have to do so much chewing for, and what is it that she is chewing, anyway?

You will need to know two things before you are able to answer this question. First, you will need to know that a cow's stomach is not like our stomachs. Her stomach has two different compartments. When she grazes over the

field, she bites off the grass and swallows each mouthful without chewing it at all. She eats, and eats, and eats; and all this unchewed grass goes directly into one of the compartments in the stomach. When this compartment is full, she goes to some shady spot and lies down. Then a most surprising thing happens. This unchewed grass in her stomach comes up into her mouth, a mouthful at a time! And as each mouthful comes up, she chews it thoroughly and then swallows it. But this time, instead of going into the first compartment, it goes into the second, or the true stomach, and there it stays until it is digested. Sometimes her stomach is so full of the unchewed grass that it takes hours for her to bring it up a mouthful at a time and chew it thoroughly enough to let it go into the true stomach. That is the reason why you see cows "chewing their cuds" so much.

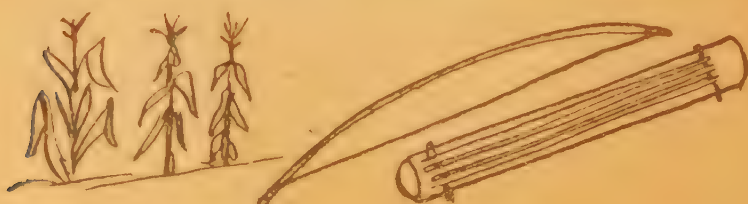
Then the second thing that you need to know, before you understand thoroughly why cows chew their cuds, is how cows used to live in past ages. Imagine the time,—many, many centuries ago,—when the cow's ancestors were all wild, and lived among fierce, flesh-eating animals. Those wild ancestors of the cow had no one to protect them from their enemies. About their only defence was hiding in dark

thickets, out of sight of the flesh-eating animals. So when they went out into the open to crop the grass and plants that they ate, they had to eat quickly and then dart back to the safe thickets. Now this is just where that double stomach of theirs helped out. You see, they could go out into the open, crop a great quantity of grass, and "swallow it whole"; then they could dash back into the thicket, before their enemies had time to spy them, and for hours afterward they could leisurely finish their meal. Of course, cows don't have to do this now; but they still have that kind of stomach, and so they still swallow their grass whole and then chew it afterward!

How To Make A Corn-Stalk Fiddle?

Of course, you cannot make a regular violin out of a corn stalk, and you must not expect even to make one that will play tunes,—at first, anyway. But you can make a little toy that will give you some good, squeaky, fiddle notes, and you will have a lot of fun making it.

For your fiddle, go over the corn patch and select the biggest stalk you can find. Cut off a piece about two feet long, near the base. With the point of your jackknife, make four cuts about an eighth of an inch apart, just through the outer skin and extending from one joint to the next. Now run



your knife under the skin so that you will lift up two long strips of the skin, leaving a space between. These strips will make the fiddle strings. Be careful not to cut through the strips. The next thing to do is to put two "bridges" under the strings so that they will be free to vibrate. Select two small twigs, or burned matches, and slip one underneath the strips at each end, close to the joint. These bridges will lift the strings up and make them tight.

Now for your bow. This is made just like the fiddle, except that you must have a much smaller stalk to make it from. If you happen to have a little rosin, it will make the bow "work" better, just as rosin helps to make the bow of a regular violin work better. By changing the position of one of the bridges, you can change the tone, and if you practice it long enough, you may be able to play a tune by moving the bridge according to the note you want.

That A Spider Can Make A Silk Balloon And Ride In It?

You probably know all about the wonderful webs that spiders weave, and perhaps you know of other interesting things that they do with the silk threads that they spin. But if you haven't watched a spider make a balloon, and then go sailing off in it, you have missed seeing the most interesting of all the things he does.

The balloon that the spider makes is not like our balloons. Instead of a bag or ball filled with gas or hot air, it is made of just two broad bands of silk, several feet long. This may seem like a queer sort of balloon to you, but it works just

as well for the spider, as an expensive, gas-filled balloon does for us.

The best time to watch a spider make a balloon and sail in it is some sunny afternoon in late summer or early fall. If you look carefully, you will be almost sure to see one or more ballooning spiders preparing to start off from the top of a fence post or the tip of a twig or grass stem.

Here is one on that old fence rail now! He has already started his balloon; for there is a foot or more of the webby band floating out from his spinning tubes. The band grows longer and longer; and as it grows, it sways back and forth gently. Now a little waft of air catches it, and it starts upward. Our little spider has to hold on tightly, for the balloon is not yet ready for the ascension. The top of the band is waving high in the air. Suddenly the spider releases his hold on the fence rail, and up he goes. The band of silk is so light that the slightest current of air wafts it upward.

Let us imagine that we can go along with him. For the first minute or two he is a busy little spider, and we see that he is just as good a sky pilot as he is a construction engineer. The moment he lets go of the fence rail he turns about, grasps the band with his front feet, and spins a little basket of silk for his other feet to rest in. After that is done, he starts another band of silk threads just like the first one. This makes the balloon still more buoyant. Longer and longer the second band grows until the upper end nearly reaches the end of the first one.

The balloon is now complete and the little aeronaut sits securely in his basket at the bottom of the two, long, glisten-

ing bands of silk that wave above him. Away it goes, over fields, farms, wood, and perhaps even over a town. Now our little spider thinks he has gone far enough, and starts preparations for landing. And how do you suppose he brings down his little silk balloon? By hauling in the bands a little at a time, and rolling them up into a tight little ball,—just as a sailor furls his sails when he wants to make port. Down he comes, slowly, but steadily, finally landing safely on a leaf by the edge of a field.

You are probably wondering why spiders take these balloon trips. Well, you see, spiders do not have wings and they have to have some way of traveling about so that they will be evenly distributed everywhere. They often travel long distances. Sometimes these spider balloons make their landing on ships way out in the ocean.

That Squirrels Plant Trees?

You must not think that a squirrel digs a hole, sets out a tree, and then packs the earth over the roots. Of course, he couldn't do this. He doesn't even know that he is planting a tree, but he does it just the same.

What the squirrel really does is this,—he plants the seed of the tree. You see, that is easy enough for him to do; but why does he do it?

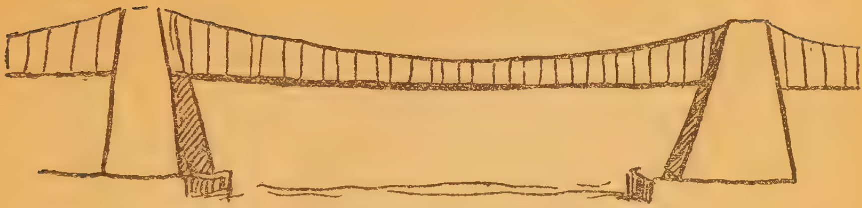
Go out into the woods some morning this fall and watch a gray squirrel; for it is this squirrel that does most of the tree planting. The other squirrels usually gather together their winter supply of nuts, and store them in some safe place until they need them. But the gray squirrel doesn't do this. He eats what he wants; then buries the rest, just as a dog buries a bone that he doesn't want to eat right off.

Now when a squirrel buries a hickory nut, an acorn, pecan nut, or whatever he happens to have and wants to save in this way, he probably thinks that he will come back some time and get it. Well, perhaps he will; and perhaps he won't. He might not find that particular nut when he is hunting for those he buried. Or something might happen to him before he could come back for it. At any rate, let us suppose that he doesn't touch it again, and that it stays there undisturbed all winter. Then in the spring, when everything is sprouting, this nut that our squirrel buried is in the best possible position to sprout and grow into a little seedling tree. And usually a seedling that has been planted in this way keeps on growing; for it has had such a good start in life.

This is how squirrels plant trees. You see, it is really one of Nature's ways of making sure that new trees will be started each year.

That Brooklyn Bridge Is Three Feet Lower in Summer Than In Winter?

Perhaps I had better tell you that if you were to measure Brooklyn Bridge from one end to the other in winter and again in summer, you would find no difference in the length. Yet at the same time it is true that the bridge



cables and steel trusses are really longer in summer than in winter and that parts of the bridge are actually lower in summer. How can this be true?

The engineers who designed Brooklyn Bridge had many hard problems to solve, for this was one of the first bridges of its kind ever built. They knew, for one thing, that steel and iron expand in hot weather, and that if all the steel trusses that support the floor of the bridge were fastened tightly together, the bridge would be all twisted out of shape when the first hot days of summer came along. So this is what they did. They designed it in such a way that in the middle of each span there would be a joint between the ends of the steel trusses. Then when the steel became heated and each truss began to grow longer and longer, the joints would gradually close up. You see, if these expansion joints were not left, the trusses would bend sideways, and that would be very dangerous.

The trusses are not the only parts of the bridge that grow longer when they are heated. The big steel cables, that really hold the floor of the bridge up, expand also. And when these cables grow longer, they sag down in the middle, and of course the floor of the bridge sags down in the middle too. It has been found that where the bridge sags

most, the floor of the bridge at that point is three feet nearer the river on a hot day in summer than on a cold day in winter.

Now you will be able to understand why the rails in railroad tracks are always placed a quarter of an inch apart.

That The Roots Of A Pumpkin Plant Are Fifteen Miles Long?

I think that I can see a surprised look on your face as you read this question. You don't believe it, do you? Well, it is so, and it has been proved.

I ought to tell you, perhaps, that no single root is fifteen miles long; it is the total length of all the roots on the plant. If you were to pull up a root of a full-grown pumpkin plant, you would see a mass of roots branching off from each main root. Now, if you could get out every root of the plant, without breaking off a single tiny rootlet, you would find that you would have a large pile of roots of all sizes. Then, if you had enough patience, when you had separated all the roots and laid them end to end, you would find that they would measure a surprisingly long distance. If your pumpkin plant was exceptionally large and vigorous, the roots might measure fifteen miles, as they did when a plant experimenter tried it once.

Do You Know?

How To Tell The Compass Directions With Your Watch?

If you are a boy scout, you may know how to do this; but if you do not know, you will always be glad that you learned how to do it, for it will be useful to you all your life.

There are a number of ways of telling the direction without a compass, but most of these ways are not always practical. For example, you have probably heard that if you find moss growing on trees, it will tell you where north is. But moss does not always grow on the north side of trees, and in many woods it cannot be found on trees at all. And then again, suppose you want to know the general direction of a city street, or which way is north when you are in the middle of a field.

Now this is where your watch comes in. If you have a watch with you, wherever you are you can tell any direction with it, almost as easily as you can tell the time. This is the way to do it: Hold the watch so that the small hand (hour hand) points to the sun; then half way between that point and twelve o'clock on the watch is south. North, of course, would be directly opposite south; and east and west would be half way between these two points. Let us see just how this works. Suppose it is two o'clock by the watch when we wish to find the direction. We point the small hand to the sun. Then half way between that point and twelve o'clock is south. In this case it would be right where the figure 1 is on the watch face. North would be in a line directly opposite the 1. This line would pass through the 7. West would be in line with the 3, and east in line

with the 10. Or, suppose it is eight o'clock in the morning. South would then be in line with the 10, north would be in line with the 4, west with the 1, and east with the 7. Of course, if it were twenty minutes past one, or ten minutes of eight, for example, it would be a little harder to estimate the directions, but after a little practice you will find that you can do it very quickly.

You may say that this way of finding the compass directions is all very well for a sunny day, but that it wouldn't work at all on a cloudy day.

Well, that is partly true; but there is a way to use this method on a cloudy day. It is apparent that if we only could tell where the sun is, we could use the watch easily enough. Now, here is a little trick that will tell you where the sun is on the cloudiest day. Stand out somewhere in an open space where there are no tall buildings or high trees near you. Then place the tip of your knife blade or a pen point in the center of your thumb nail. With a little practice you will notice that there is always a very faint shadow from the knife blade on one side of the nail. Now this shadow is made by the light that shines through the clouds. You cannot see this place when you look for it in the sky, but there is always just a little more light coming through

the clouds in front of the sun than from any other point in the sky, and this is enough to make the little shadow on your nail. So, you see, just as soon as you get this shadow you can point the hour hand of your watch to the place where you know the sun must be, and then you can easily find any compass direction.

That The London Bridge Really Did Fall Once?

I am sure that every one of you has played "London Bridge Is Falling Down." But have you ever wondered why we say that London Bridge is falling, instead of Brooklyn Bridge or some other bridge?

The real reason why we say London Bridge instead of any other bridge is because the London Bridge really did fall. But it was many, many years ago, when London had only one bridge, which was called the London Bridge.

Now this bridge did not fall just because it was weak. In fact, it did not really fall of itself at all; it was pulled down. But if we want to know why it was pulled down, we will have to go back for more than 900 years, to the time when the Danes were raiding England and had made a strong fortification on the south bank of the Thames River, opposite London.

This fort was right on the river so that the only way to attack it was by boats from the river. But every time the

English sent their boats to attack it, the soldiers on the bridge kept them back. Things went on in this way for a long time, until finally an adventurous army from Norway came to help out the English king, just for the love of fighting. The leader of the Norwegians decided that the only way to capture the Danish fort was to pull down the bridge. That seemed an impossible thing to do. But the Norwegian leader was clever and soon thought of a plan. He gave orders to have every ship, both English and Norwegian, strongly roofed over so that the arrows, spears, or rocks that the Danes hurled from the bridge would not harm the soldiers beneath. This done, the two fleets moved slowly up the river toward the bridge. Of course, when they neared the bridge they were attacked by the Danes, and one or two of the roofs were broken in; but most of the ships kept steadily moving on until they were right under the bridge. The Danes could not see what they were doing under there, but they were soon to find out. In each one of the boats was a coil of strong rope exactly the same length as the others. The soldiers in each ship tied one end of the rope around a pier of the bridge as high up as they could reach, and fastened the other end to the ship. Then at a signal from the leader, every man bent to his oar (for ships in those days, you know, were propelled mostly by big, long oars). The fleet shot quickly down stream in an even line, the rope trailing behind. Faster and faster they raced. Then, almost at the same instant, each rope straightened out with a snap. Something had to give way to this tremendous jerk, and it was the piles of the bridge that did. They swayed a little; then with a tremendous roar and splash the bridge plunged down into the river, carrying all the Danes with it.

The greatest obstacle to taking the Danish fort was now removed. The ships attacked it with their covered boats and took it. Then the Danes were soon driven out of the country. So, you see, the fall of London Bridge really saved the country from being captured by the Danes.

How To Tell How Fast You Are Traveling On a Train?

When you are riding along on a railroad train, especially if you are sitting near one end of a car with the windows or doors open, you can hear the constant click-i-ti-click, click-i-ti-click of the car wheels. This sound is made when the back set of wheels of one car and the forward set of the next car pass over the joints of the rails.

Now, the standard length of a railroad rail is about thirty feet. So, you see, if you should count the number of clicks in a given time, you could tell how fast you are going. Let us suppose that you are sitting by an open window near one end of the car, so that you can hear only the clicks from the rails on one side. You could, of course, count the number of clicks in an hour, multiply this by the number of feet in a rail (30), and then divide by the number of feet in a mile (5,280). This would give you the number of miles you had traveled during the hour. But a much quicker way, and one

that will give the approximate speed at any particular moment, is simply to count the number of clicks in 20 seconds. For example, if you find that at the end of 20 seconds you have counted 40 clicks, you know that you have been traveling at a rate of 40 miles an hour.

How Far You Could Jump If Your Legs Were As Strong As A Grasshopper's?

Have you ever watched a grasshopper when you suddenly disturbed him? He gives a vigorous spring and goes flying through the air to some grass blade or weed stem several feet away. If the grasshopper you saw was a good, healthy, full-grown grasshopper, and if he had a firm "foothold" when he started to jump, the chances are that he landed anywhere from eight to sixteen feet away.

Let us suppose that your grasshopper made a record jump the time you saw him. I am not sure just what the record for a grasshopper is, for I have never heard of a grasshopper track meet in which the champion grasshopper broad jumper of the world made his record, have you? At any rate, men who have studied grasshoppers say that it is possible for a grasshopper to jump a distance which is nearly 200 times his own length.

Suppose your legs were as powerful as a champion grasshopper's legs. Just think what you could do then! Why, with hardly any effort you could give a spring and land about 800 feet away—almost a sixth of a mile! And it would be really an easy thing for you to jump over your house. But perhaps, after all, it would be rather dangerous to have such powerful legs. Just think, suppose you had started to jump over the house from one side, and your playmate started to jump over from the other side, without knowing that you had started. What would you do when

you found yourselves coming together through the air at express speed, without any rudders to swerve you to one side? It is different with a grasshopper. When he hits an object before he gets to the end of his jump, it doesn't hurt him, even if he falls to the ground, for he is of course a million times lighter than you are.

How Long Little Girls Have Played With Dolls?

We know that at least three thousand years ago, possibly four thousand, little Egyptian girls played with dolls beside the Nile River. Four thousand years is a long, long time—almost too long to try to imagine, isn't it?

If you could go to some of the big world museums in which such things are kept, you could see the very dolls themselves, which have been lying beside their little mistresses in the catacombs of Egypt during all these long ages. They are carefully carved and painted, and are well preserved. They are quite different in appearance from your own "Sarah Ann" or "Claribel," but nevertheless they are real dolls just the same, and probably their little owners thought just as much of them as you do of your own dolls.

Egyptian girls were not the only girls in ancient times who played with dolls, however. They have been dug up or found in various places all over the world. Some of our own North American Indian girls used to play with dolls made of corn husks. It will probably be easier for you to imagine a little Indian girl singing a lullaby to her corn-husk doll beside her father's wigwam than it would be for you to imagine an Egyptian girl beside the Nile with her carved and painted doll. And you will probably have an opportunity some day to see some of these very corn-husk dolls that these little Indian girls played with, for they have been carefully saved and may be seen in several of the museums right here in our own country.

Do You Know?

What Smoke Is?

The reason a flame is yellow is because the tiny carbon particles are not entirely burned up but are merely heated to a yellow heat. If you understand that all right, it will be easy for you to understand what smoke is.

These tiny carbon particles do not burn up because they do not get air enough. Well, let us suppose that this flame gets still less air. Then, you see, many of the particles will not even get hot enough to glow. And because all these particles are not hot enough to glow or burn up, they pass off into the air as smoke. The particles that make up smoke are very, very small,—so small that you probably could not even see one of them if you separated it from all the others. It is only because there are so many millions of them close together that they can be seen at all.

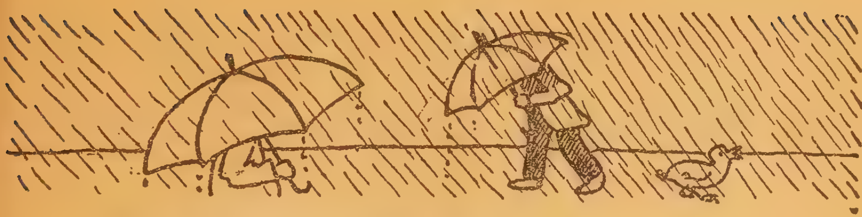
When smoke goes off into the air, the farther away it gets, the more it spreads out. And as it spreads out, the particles in it get farther and farther apart. That, you see, is the reason why smoke disappears after a while. The particles are still there, but they are so far apart we cannot see them.

What A Sunbeam Is Made Of?

You probably are saying to yourself that a sunbeam is made of sunlight. Well, it is—partly—but that is not the whole story.

Perhaps I had better make sure that you understand first what I mean when I say "sunbeam." We usually speak of sunbeams as the rays of sunlight that we often see when the sun shines through a hole in a cloud or through a window into a room. Usually we don't see sunlight until it strikes something—the earth, trees, houses, rocks, and the like. We can't see it as it passes through the air unless it strikes something as it passes through.

There is the secret! When you can see the rays of the sun out-of-doors, it is because there is a lot of moisture in the atmosphere, and it is the sunlight striking these particles of moisture that makes the ray visible. Every one of these little particles of moisture reflects the sunlight a little; so what we really see is the sunlight that is shining on these particles. And in the same way, when we see a sunbeam in a room, it is the sunlight shining on the millions of tiny dust particles floating in the air.



How Much Rain Falls In An April Shower?

April showers are, of course, all different. Some last for hours, flooding all the streets and low places everywhere. Others are so slight that we can hardly call them showers—"sprinkles" would be a better name. Yet, if you could collect after one of these little showers every one of the drops that fell on your front lawn, your garden, or a small patch of the roadway in front of your home, you might be surprised at the amount of water you would have.

Let us suppose that a dark cloud appears overhead and rain commences to fall. You run as fast as you can and rush into the house, only to find that almost as soon as you get there the rain has stopped and the sun is shining again. The shower has lasted only a few minutes, and probably not more than one one-hundredth of an inch of rain fell. But if you had some way of gathering together every drop of water that fell on a patch of ground about fifty feet square, before it dried up or soaked into the ground, you would have about ten or twelve gallons. You can easily see what a great amount of water really falls over a large area during these very few minutes.

Now let us imagine one of those April showers in which the rain comes down so fast that it has no time to run off or soak into the ground. If such a shower keeps up for a half-hour steadily, an enormous amount of water may fall—enough to cover the ground to a depth of from one-half to

one inch everywhere, if it had no way of running off. The total amount of water that fell on your fifty-foot patch of ground during such a shower would probably be two or three hundred gallons!

How December Got Its Name?

December, you know, is the last month in the year. And as there are twelve months in each year, December is the twelfth month.

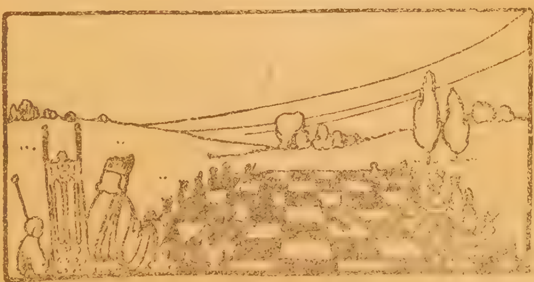
But December wasn't always the twelfth month. Many, many years ago, when the Romans ruled the world, the year was divided into ten months only. And as December was the last month then also, it was the tenth month instead of the twelfth. Now the old Roman word for ten was decem, and that is why they called the last month Decem-ber. After many years the old ten-month year was divided into twelve months instead of ten. All of the old names were kept, but two new ones, January and February, were added. These two became the first two months, instead of March and April. December, you see, then became the twelfth month, but kept its old name which means "tenth month."

That Real Live Men Were Once Used For Chessmen?

You may have played chess. Perhaps you received a game for a Christmas present. But if you have never played it, you ought to know something about it; for chess has been played for so many years that no one really knows when the game first appeared.

The game of chess has been played in many different ways, in different countries and at different times. But perhaps the most interesting of these various ways is the way an old emperor in India played it. This emperor lived some hundreds of years ago. He was always very fond of chess. In fact, he was so much interested in it that he had a big chessboard laid out on the ground in back of his palace. And instead of the wooden or ivory chessmen that we have for players, he used real live men, dressed up in costume to represent the various chessmen, one set in white and the other in black.

A game in progress on this big chessboard must have been a gorgeous sight. If you can imagine sixteen men dressed as figures that represent kings, queens, rooks (warriors), knights, and bishops, and sixteen dressed in plain costumes (the pawns); and then if you can imagine these strikingly dressed men standing in various positions on this big chessboard, with its numerous white and black squares—if you can imaggine such a scene, you will have a good idea of this "living chessboard." The emperor sat beside the board and direct-



ed the plays by ordering one or another of the players to move, just as he would do in a table game, except that instead of moving the men himself he just gave the order to move and the men advanced to the right or left, retreated, or "jumped," according to the move he wished to make. I have often thought that if this emperor sat at his chess games as long as some persons do to-day, those chessmen must have become rather tired after standing in one position hour after hour, perhaps all day long!

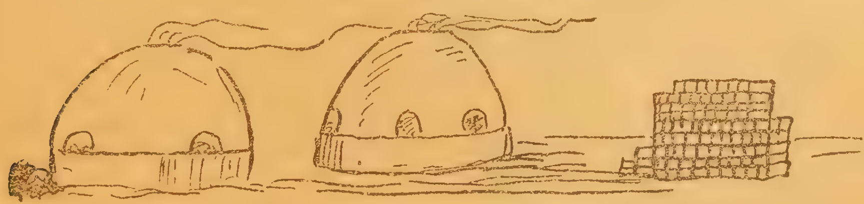
The city in which this big chessboard was laid out became deserted soon after the time when this old emperor played his games of chess with real live chessmen, and ever since it has been known as the "deserted city." If you were to go there yourself to-day, you would see the ruins of the palace and you could trace out the big chessboard near it.

Do You Know?

Why Some Bricks Are Red and Some Yellow?

Bricks, as you probably know, are made from clay. Now pure clay is very hard to find, and that is usually made into the finer grades of porcelain. Most of the clay found in clay pits has one or more additional substances. The clay that when made into bricks and baked, turns red, contains a large percentage of iron. Now before this clay is baked it is not red; it is a grayish color. The heat used in baking the clay into bricks changes the iron into iron oxide, which is a bright red color. It is this iron oxide that gives the red color to red bricks. A familiar form of iron oxide is seen whenever iron rusts.

The yellow bricks have a slightly different story. The clay used to make these bricks has little or no iron in it, but it usually does have a large percentage of lime. Now lime, as you know, is white or nearly white. The reason the bricks turn yellow is because there is either a slight amount of iron in the clay or some other material which turns a yellowish color when the brick is baked. If there were none of these materials which turn the brick a yellowish color, it would be pure white, and would be more like porcelain than brick.

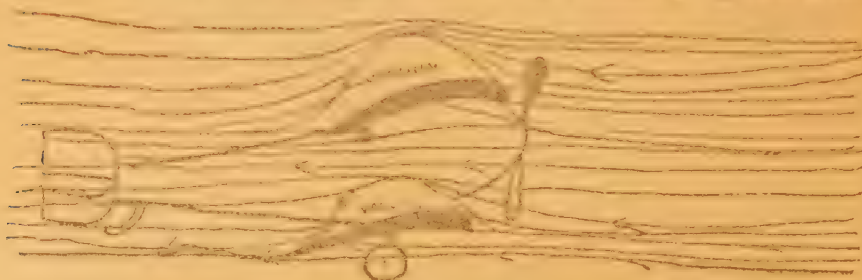


What Makes An Airplane Fly?

Of course, you may say that it is the engine in the airplane that makes it fly. You are partly right, because that is what makes the airplane go through the air. However, that does not answer the question, "What holds the airplane up?"

Before we find out just what does hold the airplane up, let us first find out what holds your kite up when you fly it. You know that if there were no wind your kite would not fly. It is the wind pushing against the under side of the kite that keeps it up in the air. Your string merely holds the kite while the wind pushes against it. If you did not hold it by the string, you know that the kite would soon fall down. You may perhaps also know that unless the kite is tilted at a certain angle it will not fly at all. It is the rush of wind pushing against the under side of the kite that keeps forcing it up. At the same time your string keeps it from being blown away by the wind.

Now let us turn to the airplane. About the same thing happens when an airplane is flying; except, of course, there is no string hitched to the airplane. It is the engine that really creates the wind by pushing the wings swiftly against the air. Airplane wings are always tilted up a little bit so that when the engine is started the propeller pulls the airplane along and the air rushing against the



under side of the wings tends to push the whole plane upward.

This pushing of the air against the under side of the airplane wings is only part of the secret, however. The second part is very important, and this is what kept the inventors of airplanes from succeeding so long. Finally, after long experimenting, it was found that if the wings of the airplane were shaped in such a way that there was a sharp curve on the top side and at the front of each wing, the air rushing against the edges of the wings would tend to shoot upwards and not follow exactly the top surface of the wings. The principle is something like that of the windshields in some of our open automobiles and motorcycles. You know they are curved inward slightly and you can sit back of this windshield with your head a little above it and yet not feel the full force of the wind. This is because the wind strikes the curved surface of the windshield and is forced upward over your head.

Coming back to our airplane again, the effect of this curved surface in the front edges of the planes is to shoot the air upwards, leaving between the current of air that passes over the top of the plane and the top surface of the wings a space in which there is a sort of vacuum. (See illustration.) If you have ever experimented with a rubber sucker attached to a string, you know that when you press the rubber flat against any object that is not too heavy, you can lift that object up, just as if that rubber sucker were glued firmly to the object which you lift. That is because of the vacuum between the rubber and the object which you are lifting. You know that all the air around us, and even up to quite a height above us, is under an enormous pressure. If some of this air is removed, the air surrounding this space tries hard to get into it. In the case of the sucker the air all around the sucker and around the object that you are lifting is trying to

get into that vacuum. It is pushing very hard and it is really the air pressure pushing against the object you are lifting that holds the sucker to the object.

You can probably see now that as the airplane gets going and this vacuum is formed just above the top of each wing, as shown in the accompanying illustration, the air underneath the wings is trying hard to push up into the vacuum. All of this tends to keep the airplane up.

It is a combination, then, of the air pressure against the under side of the airplane, and the vacuum just above each wing that keeps the airplane up in the air. Of course, the engine must drive the plane through the air at a high speed in order to make both the pressure against the under side of the wing and create the vacuum on the upper sides of the wing.

There is one other thing that you should keep in mind when you are thinking of an airplane flying through the air. We cannot see air, so it is hard for us to believe that air is really a substance. Yet it is a substance just as much as water, only it is very much thinner, of course, than water. You must think that when an airplane is flying through the air it is not really just flying through nothing, but pushing through a substance which holds it up, almost as well as water holds up a boat.

One more thing we should know, before we understand perfectly just how airplanes fly. Airplanes are usually made with two wings. If you have ever seen an airplane close up, you have probably noticed that the upper wing is set a little bit ahead of the lower wing. This is to prevent the upper wing from interfering with the vacuum which is made just above the lower wing. If the upper wing were directly above the lower wing, there would not be such a good vacuum on the lower wing, and the airplane would not stay up so well.

Why Winter Is Colder Than Summer?

You may at first think that this is a very easy question to answer, and that it is merely because the air becomes colder.

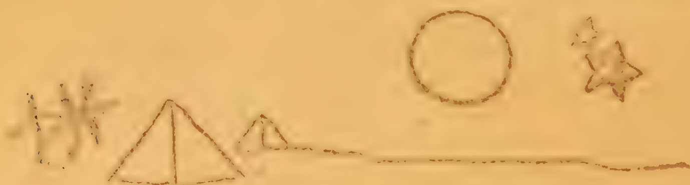
Of course the air getting colder is the immediate cause of winter, but what makes the air become colder in the winter? To find out the reason for this cause, we must first remember that the sun is very much lower in the sky than it is in summer. There is just as much heat coming from the sun in winter as in summer, although the sunlight does not feel nearly so warm to us. There are two reasons why it does not feel so warm to us when it is down lower in the sky. The first is that it has to travel through more air before it reaches us, and this air absorbs some of the heat on the way to us.

To find out the principal reason why the sunlight is not so warm in winter as it is in summer, we must try to imagine a beam of sunlight, covering a definite area—say a square mile, when the sun is high in the sky, as it is in summer. This same beam of light, when the sun is lower in the sky, as it is in winter, will cover a much larger area on the earth than it does in summer. To understand this properly we should look at the accompanying diagram. You can readily see now that in the summer time a given area of land receives just about twice the amount of heat that the same area does in winter.

The sun, as you probably know, reaches its highest point in the sky on the 21st of June, and from that time until

the 21st of December, it gradually gets lower in the sky. All this time the earth is receiving less heat than it did when the sun was higher in the sky. You may wonder, then, why the summer and fall is not colder than the winter and spring. The reason is because we do not begin to feel the effects of the heat of the sun from the time it starts to climb the sky in January to July until the earth has become thoroughly warmed up. In other words, the heat received in the latter part of winter and in spring is really not felt until the earth gets thoroughly warmed up. On the other hand, after the earth is thoroughly warmed up, it takes a long time to cool off; so it is not until October or November that we commence to feel the effects of this cooling off.

One other thing helps to make it colder in winter than in summer. Besides being lower in the sky, the sun does not stay up in the sky so long in winter as it does in summer. Less heat is received from the sun on a short day, of course, than on a long day. And what is more important still, the heat that is received has a longer time to radiate out into space during the long nights of the fall and winter.



What Dog Days Are?

You have probably heard that dogs are more likely to go mad during the hot, sultry period of the summer, usually called dog days. This period really has nothing to do with dogs, and dogs do not go mad at this time any more than they do at other times.

To find out why they are called dog days instead of "bug days," or some other names which might be more appropriate, we shall have to look into the sky for our answer. One of the constellations, or groups of stars, is known as Canis Major. In English this means "the big dog." One of the brightest stars in the sky is in this constellation. This is Sirius, which shines so brightly in the south all through the winter nights. Sirius is called the "dog star."

You may perhaps know that the sun gradually moves among the stars (or at least appears to move), slowly progressing eastward until it comes back to the same place from which it starts at the beginning of the year. Now by the time summer has arrived, the sun has reached a position which is near the constellation of Canis Major. At this time of the year we cannot see this constellation, because it rises at about the same time as the sun, and also sets with the sun.

In the early days of civilization, when the constellations meant more to people than they do now, the sun and its position among the stars was watched very closely. People used to say, for example, that the "sun is now with the big dog," and after a while began to call this period, when the "sun was with the big dog," dog days.

You may be interested to know why Sirius is called the dog star. To find this out we must go back to ancient Egypt, some three or four thousand years ago. You know that Egypt is a long, narrow country, and that the only part of the country where crops can be raised is along the banks of the Nile River. Once each year the Nile overflowed its banks and deposited a coating of fertile soil over the lands on which the crops were grown in those times.

Now this overflow of the Nile meant much to the ancient Egyptians, and they watched for it with great anxiety.

They learned after a while, that when the star Sirius began to appear in the sky that the season of the overflow was at hand. They began to associate the appearance of Sirius with the overflow and came to regard the faithful appearance of the star with veneration. They compared this faithfulness of Sirius in appearing so regularly to announce to them that the season of the overflow was at hand, with the faithfulness of a dog. Now dogs, as you may perhaps know, were held in great esteem in ancient Egypt, and so it was only natural that they would call this faithful star the "dog star."

How Long Hockey Has Been Played?

When you play hockey, you may not have thought very much about how long it has been played. If you did wonder about it, you probably had thought that it has been played for perhaps fifty or a hundred years. Even that may seem a long time to you, but what would you say if I said that it was played twenty-four hundred years ago.

When scientists were making excavations near Athens and Greece at one time, they came upon a very interesting discovery. In one of the sea walls built by the ancient Greek, Themistocles, about 500 B. C., they found a bas-relief, which showed very plainly a group of ancient Greek boys playing a game of hockey. The hockey sticks that they used were almost identical with those we use today.

Not only has it been found that hockey was played in ancient Greece twenty-four hundred years ago, but it has been traced to Persia to a period considerably before the time when it was played in Greece. Probably it had its first beginnings in Persia.

Those who have studied the games of the American Indian find that the Indians also had a sort of crude hockey game which was played with a stick and ball, much the same as hockey is played by us.

Hockey is only one of several games which has come down to us from a period of great antiquity. Many of our modern games, such as basket-ball, have been invented in very recent times, but others can be traced way back to a period even before civilization began.

Why Some Animals Disappear in Winter?

You know that some of the animals that you have seen all summer long begin to drop out of sight when the cool days of fall arrive. Woodchucks, badgers, chipmunks, bears, skunks, bats, frogs, turtles and snakes disappear and we don't see them again until next spring. Where do they go? Why don't they stay around as the other animals do?

Of course you know that in the fall nearly all of our birds go south, and only those birds that can find plenty

to eat in winter stay with us. Now the animals do something like that, but in a very much different way. All those animals that can find enough food to eat in winter stay around. But those animals that cannot find enough food in winter—or are too lazy to hunt for it—what do they do? They don't go south as the birds do; they go into caves, into hollow trees and even down into the ground! And not only do they go into these queer places, but most of them sleep there all winter long. What a queer place to spend the winter, you say, and what a waste of time to spend so much of it sleeping. Well, perhaps it would be queer for you. But if you couldn't get anything to eat all winter long, maybe you wouldn't mind sleeping all the winter, even if you did have to sleep in the ground.

That is the reason why some animals sleep so much in winter. The woodchuck, for example, depends mostly on growing plants for his food. If he tried to keep awake all winter, he would be pretty sure to starve to death long before winter is over. And he is too lazy to hunt for his food, the way the rabbit does. The skunk is not lazy, but he is mostly an insect eater; so he, too, must sleep during the time when the insects are scarce. It is the same way with the bear. He eats mostly berries and insects, and of course there are not many of these to be found in winter. A bear might get along through the winter by catching other animals, for he often does this in summer. But he doesn't. He is another lazy fellow, and he prefers to store up a big layer of fat and live on that during the cold days. The badger, too, could probably catch enough of the other animals to keep him alive in winter. But, like the bear, the badger prefers to store up fat and then sleep in his snug little burrow while the snow swirls outside. Another one of the furry animals, the jumping mouse, likes to sleep a long time in the winter. There is one animal that you may not have thought of as an animal at all, for he looks

more like a bird than an animal. He never walks, he flies! Yes, that's right, it is the bat. Now the bat, as you may know, eats nothing but insects, which he catches while flying through the air. So as there are no insects flying through the air in winter, he must spend the time sleeping. When cold weather approaches, he goes into a cave, a hollow tree, or a barn loft. Here he hangs himself up by his toes and sleeps, head downward, all winter long!

The chipmunk is not lazy, and there is really enough food for him if he would hustle around and get it, as some of the squirrels do. But he has a better way of spending the winter. He just collects a store of food and packs it away safely in his burrow. But this does not prevent him from sleeping. It just gives him something to eat whenever he wakes up.

Most of these sleeping animals are rather restless. They cannot seem to sleep all the time. The little chipmunk very seldom comes out into the cold world on a winter day. But every once in a while he wakes up and makes a good meal of nuts and seeds that he carefully stored away last fall. Then he gets sleepy again and goes off into another long nap that may last for days and even weeks. The raccoon is another restless sleeper. When the first cold weather of winter comes, he curls up in a hollow tree with two or three other raccoons. Sometimes several families of raccoons will spend the winter in the same hollow tree. But just as soon as a warm day comes along, he wakes up and begins to prowl around. Then if it becomes cold again, back he will go and stay until the next warm day. He keeps doing this all winter long.

The squirrel wakes up often. And when he wakes up he usually comes out, especially if his nut supply is all gone, or if he didn't store any food away, which often happens. You may have seen him this winter prowling about

in the snow, looking for a stray pine cone or nut that did not get carried away or eaten in the fall.

Along about February some of the deeper sleeping animals begin to hear nature's alarm clock. The skunk may hear it and come out. And when he is once thoroughly awake it is hard for him to get to sleep again. He may have a hungry time of it until the insects and frogs begin to wake up. The woodchucks store up so much fat in the fall that they do not wake up until the latter part of February or early March. But by April nature's alarm clock is ringing loudly, and nearly all the sleepy heads are awake. And the longer the woodchucks have slept the hungrier they are. It is fortunate for them that the spring days bring back more and more of their food as nature's alarm clock keeps on ringing!

The sleep of the winter animals is a very deep sleep. It is such a deep sleep that they hardly breathe. When they do breathe it is very slowly and so slight that a special instrument would have to be used to tell just when and how much they do breathe. And because they breathe so slowly, they require almost no food. In fact, many of the sleeping winter animals do not eat at all from the time they go to sleep in the fall until they wake up in the spring.

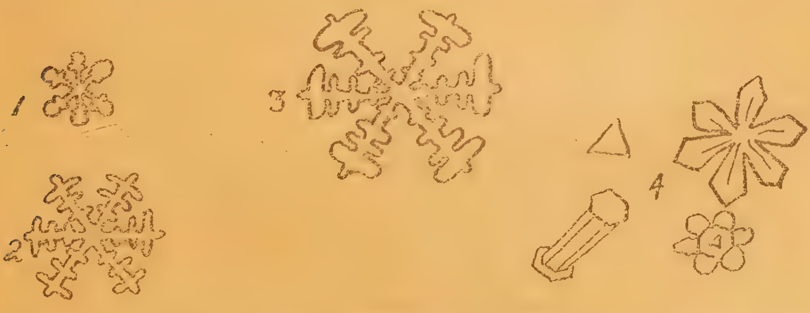
This deep winter sleep of the animals is called hibernation. Now the word "hibernation" does not exactly mean "sleeping." It is made from the Latin word hibernatus, which means winter-time or wintry. When we heard this word "hibernation" it should mean more to us than merely "sleeping." We should think of it as the long deep winter sleep not only of some of the furry animals, but of all the frogs, snakes, toads and insects. We should think of it as a sleep so deep that the breathing, the digestion, and even the heart beats are slowed down so much that they almost stop.

Do You Know?

How Snowflakes Are Made?

You may have often looked up into the sky and wondered just where all the snowflakes are coming from during a snowstorm. The clouds do not just turn into snowflakes, as you may have supposed. In a way they are made from the clouds, but by a very roundabout and interesting process.

Whenever the water vapor in the upper atmosphere is condensing, and the temperature is below the freezing point, snowflakes form. Each snowflake usually begins as a tiny dust particle. This may seem rather strange to you, but there are always billions and billions of tiny dust particles floating in the air everywhere. The condensing moisture starts to freeze about one of these tiny dust particles. As the moisture is deposited and turns into ice, from the very beginning it takes the shape of a hexagon, or a triangle. As the moisture keeps condensing on our tiny



snowflake, and it grows larger and larger, it keeps strictly to the hexagonal form. You know that "hexagonal" means six-sided or six-pointed. As these little points grow out from the snowflakes, numerous side branches start to

grow out from the six main points. Always as these side branches grow, they keep the same angle between themselves and the main point that is characteristic of the hexagon.

Now let us suppose that our snowflake which we have watched grow up to this point is continuing to grow still larger. If the conditions in the atmosphere stay just as they were at first, our snowflake keeps on growing until it has become so heavy that it cannot be held up any longer by the currents of air. Then it starts to fall to the ground of its own weight. However, atmospheric conditions may change at any time. Perhaps it may get warmer. Then the snowflake will start to melt. Again it may get colder, then it would start to grow again. In the end it would have an entirely different form from the form it had in the first place. Sometimes when the temperature is just right several snowflakes will come together and combine into one snowflake.

Almost every snowstorm will show us a different type of snowflake. They have an infinite variety, from simple triangles to the most complicated and feathery six-pointed types. Some of them even are made in the shape of a six-sided rod with six-sided flat ends, looking for all the world like exquisitely formed cuff links. The number of different types of snowflakes is almost unbelievable. One man, who has made a study of snowflakes all his life, has photographed over thirteen hundred types, each distinct from any of the others.

Why the Ice on Ponds and Lakes Forms at the Top Instead of at the Bottom?

In the first place, it is a rather fortunate thing for you that ice does form at the top of ponds instead of the bottom, for if it formed at the bottom, you would never have

any skating unless you lived in an extremely cold climate, for it would take all winter before the ice reached the surface, and probably it would not freeze at the surface before spring began.

The principal reason water freezes at the top of the pond first instead of at the bottom, is because of a peculiar habit that water has when it becomes cold. Almost everything contracts when it starts to get colder, and consequently becomes a little heavier. This is true of water—up to a certain point. When water starts to become cold it contracts or condenses, thus becoming heavier, until it reaches a temperature of 39 degrees. That temperature, you know, is still 7 degrees above the freezing point, or when ice commences to form.

Now let us see just exactly what happens in the winter just before the ice commences to form over the pond. As

the surface water cools, when the air about it becomes cooler, it condenses, and sinks to the bottom of the pond, because it is heavier than the water below it. The warmer water from below consequently rises, because it is lighter. This sinking of the heavier water and rising of the warmer water keeps up until the temperature of the water in the whole pond reaches 39 degrees. Now a strange thing happens. When water gets colder than 39 degrees, instead of condensing and getting heavier, it expands and becomes lighter. Suppose now that the surface water in our pond dropped to, say, 35 degrees. Instead of falling to the bottom of the pond, as it would if the temperature were above

39 degrees, it stays right there on the top. If the air continues to be cold, the temperature of the surface water keeps going down until it reaches 32 degrees, when it commences to turn into ice.

Now we have a thin coating of ice on the surface of the pond, with a temperature of approximately 32 degrees. All of the rest of the water in the pond, with the exception of the water immediately below the ice, is about 39 degrees. This ice on the surface acts as a sort of blanket which tends to keep the temperature of the water below it about 39 degrees, or at least prevents it from going down to the freezing point. It would have to be a very severe winter indeed which would be cold enough to freeze the ice from the surface way down to the bottom of the pond. Ordinarily, even in the coldest climates, water does not freeze more than a foot or two below the surface.

Now besides enabling you to skate during an ordinary winter, this habit of water, which makes it possible for the ice to freeze on the surface first instead of at the bottom, is helpful in many other ways. It is a good thing for us that the water does not freeze at the bottom first, for in the first place many of our shallower ponds and streams would freeze solid. Now it would take much more heat than we get in the average summer to melt all this ice. You can readily see that no fish or, in fact, any of the higher forms of life could live in the pond under such conditions. Furthermore, the whole climate would be changed, and what is now the Temperate Zone, where most of us live, would become as cold as the Arctic Regions, and we should all be forced to live in the regions now occupied by the Tropics.

So, you see, this strange habit that water has of expanding when it becomes cold is a very important habit after all.

How Soap Cleans Your Hands?

You know that it is always much easier to get your hands really clean when you use soap than it is when you do not use it, especially if your hands are at all greasy or oily.

In order to find out just how soap goes about this business of taking the grease from our hands or from soiled clothes, we must find out first something about an emulsion. If you were to pour some oil in a bottle of water and then shake the bottle vigorously, the oil would be divided up into thousands of tiny droplets. Now if you let this water and oil stand, the oil would gradually run together. Now let us suppose that we had put into this water some soap, before we put the oil in. Then when we shook up the bottle, the oil would divide up into tiny droplets as before; but this time the soap in the water would form a thin film around each one of those droplets of oil. This thin film acts as a sort of insulator, preventing the oil drops from running together. When this takes place we say that the oil is in a state of emulsion.

Now almost exactly the same thing happens when you wash your hands, or when greasy clothes are washed with water, oil and soap. When you start to wash your hands

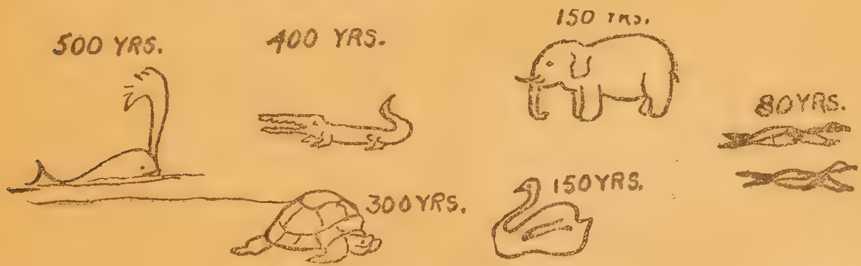
you first get them wet. This water corresponds to the soap, as happened when you made that emulsion with water in the bottle; the oil or grease on your hands corresponds to the oil in the bottle; and the soap on your hands to the soap you put into the bottle. Then when you rub your hands you are carrying out essentially the same process as you carried out when you shook the bottle and emulsified the oil drops. The rubbing of your hands breaks up the grease, and the soap surrounds each particle of grease or oil and really emulsifies it. Each one of these thousands of tiny particles of grease or oil will then separate. It is easy to see now that when you rinse your hands the water readily washes away all the grease, oil, or dirt that may be on your hands.

Why You Couldn't Hear Anything If You Lived on the Moon?

In the first place you never could live on the moon, even if you could manage to get there, because there is no atmosphere, and you know that without oxygen you could not live more than a few minutes. But suppose you and a friend of yours did get to the moon and started to talk with each other. You would open your mouth and say, perhaps, "How do you feel after your long trip, Bill?" Now Bill would see your mouth go, but he would hear

nothing, and he might say, "What did you say, Tom?" Then it would be your turn to see Bill's mouth go and hear nothing. Then you would both probably say to yourselves, "Why, I must be deaf and dumb. I can't either speak or hear."

Why is it that you and your friend could not talk to each other on the moon? You probably do not suspect when you are talking every day that if it were not for the air around you, you could neither make any one else hear nor could you hear anything yourself. Sound is made when a series of air waves is set up. When you talk, the larynx in your throat and your palate start vibrations in the air that spread all around you through the air and reach the eardrums of those listening. It is because there is no air on the moon to carry these sound waves that you were unable to hear your friend Bill when he talked to you up there in the moon.



How Long Animals Live?

You have probably heard that some animals live to a very old age, and that others do not live very long, but you probably do not realize that some animals live to be nearly 500 years and that others live only a few hours.

Men who have studied animals find that by actually keeping some animals in captivity or by estimating the age by the rate of growth, they can tell pretty well just how long these animals live. They have found out, for example, that a whale may live to be something like 500 years. Just think what that means! If there happened to be a young whale swimming around the West Indies in the day that Christopher Columbus landed, it is possible that this whale saw Columbus land at that time, and that he is still living. Certainly a whale living today could have seen the Pilgrims landing at Plymouth Rock or he might have seen the Boston Tea Party. Of course, it is quite likely that if there were any whales that witnessed these great events, they have long since been killed off; but this might have happened.

The next group of animals that live to be a very old age are the turtles and alligators. Some turtles reach an age of from 300 years to 350 years. Some of the larger alligators living today are thought to be more than 400 years old. The carp lives about 20 years. Even your little goldfish, if you cared for him properly, might live to be over 100 years. In fact, there is a record of a goldfish that was kept in captivity for over 100 years. The elephant lives to be about 150 years. Even the eagle sometimes lives to be a hundred years.

Coming now to our domestic animals, we find that swans may live 150 years, while geese can live to be 80 years old. A pigeon lives to be 20 years old, if properly cared for. Most of the other domestic animals live to be about from 20 to 40 years old.

Now let us turn to the animals that live the shortest time. Of course, you may not think of an insect as an animal; but zoologists always include the insects with the animals. The majority of insects that you see in the summer live to be only a month or so. Some of them live sev-

eral months. In the case of the monarch butterfly, that migrates, he may live nearly a year, because when cool weather comes he flies to the South; and if nothing happens to him, he may start back again northward in the spring. Then there are the seventeen-year locusts, which spend all but a few weeks of that whole seventeen years underground.

The May fly emerges from the water, where he spends the first part of his life, he flies around and usually congregates with hundreds of other May flies. Together they dance about in the air and in general have a very good time, but this lasts only for a very few hours, perhaps only four or five. At the end of that time they die and drop to the ground.

How the Cranberry Got Its Name?

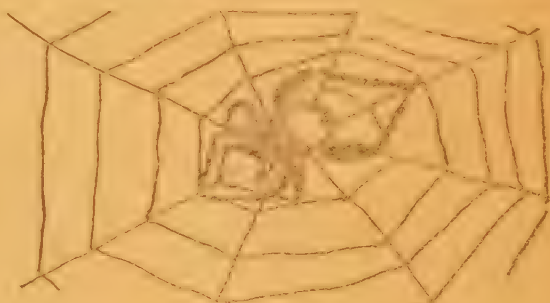
You may have thought that the name cranberry was a corruption of cramberry; but this is not so. To find out just how this little plant got its name, we must look closely at the plant, and especially at the tiny flowers. The flowers have a curved stalk, and the pistil is very prominent. The whole shape of the flower suggested to the early settlers, who first noticed the cranberry plant, a crane's head. The stem represented the long curved neck, the base of the flower the head, and the pistil the long sharp bill. So these early settlers called the plant the crane-berry. As time went on this word became corrupted from crane-berry to cran-berry, and finally to cranberry.

Do You Know?

Why Some Insects Paralyze Other Insects and Put Them in Cold Storage?

These paralyzed insects are not exactly put in cold storage, for insects have no refrigerating system. However, they keep just as well as they would if put in cold storage. And what is more remarkable, they are still alive after a period of several weeks or even months in this strange storage.

If you were to watch closely a mud dauber while he is building that queer mud nest of his on the walls of your attic or under the eaves of your house, you would see that in building this house he makes a series of tubes, one at a time. When one tube is finished, he (or rather she, for it is the female mud daubers that always do this house building) disappears, and the next time she comes back she is carrying a limp spider. She at once proceeds to cram this



spider into the open tube in the mud house. She disappears again, comes back with another spider, and puts it in the tube. She repeats this until the whole tube is packed tightly full of spiders. Then she lays an egg among

these spiders, and seals over the top of the tube with more mud. She then proceeds to construct another tube, and repeats the whole process, laying one egg in each tube or cell full of paralyzed spiders. Now let us go into the fields and watch the wasp while she is collecting these spiders. We would see her hunting around until she found a spider. Then, watching her chance, she would rush at the spider and give it a sharp jab with her sting. After a few moments of struggling the spider becomes still, and the wasp gathers it up and flies with it back to her mud nest. Just what happened when the wasp stung the spider? In the first place, the wasp always selects one particular spot on the spider. This spot is the place where a number of nerves in the spider come together. In fact, there are two such spots on the spider, and the wasp usually drives her sting into both of these places. When the wasp drove her sting into this nerve center in the spider, she also deposited among the nerves a tiny drop of poison. This poison is almost magic in its effect, completely paralyzing the nerves of the spider. Not only that, but it has the strange power of keeping the spider in a state of suspended animation almost indefinitely.

Perhaps you have guessed by this time why the wasp paralyzes the spider in this way. After she lays her egg among these paralyzed spiders, it of course takes several days before the egg hatches, and it is a matter of several days more before the young wasp larva which hatches out of the egg obtains its full size. You see that if the wasp failed to paralyze the spider which she put in for the purpose of providing the young larva with food, just as soon as the baby wasp larva hatched out, the spider would turn upon him and eat him up, thus defeating the whole plan of the mother wasp. These spiders then stay conveniently paralyzed until the wasp has grown up, and is thus pro-

vided with fresh meat during the entire period of his growth, without the danger of being eaten himself.

The mud daubers are only one of a long list of insects which paralyze and store other insects, in order to provide food for their babies while they are attaining their growth. One of the most interesting of these insects is the jug builder. This is another wasp, something like the mud dauber. He builds a mud nest, but instead of building a series of tubes bound roughly together with mud, he builds a perfect little clay jug about a half or three-quarters of an inch high, and about the same diameter. Into this jug the mother wasp stuffs—not spiders, but caterpillars, which she has paralyzed in the same way in which the mud dauber paralyzed and stored the spiders. Of course she does not fail to lay her precious egg among the paralyzed caterpillars before sealing up the mouth of the jug.

A number of wasps dig burrows in the ground, instead of building mud nests, and provision these burrows with all sorts of insects. Some select spiders, others caterpillars, others flies, etc. All these wasps which dig burrows in the ground and store paralyzed insects are called "grave diggers" or "digger wasps." Perhaps the most interesting "digger wasp" is the large and powerful sand hornet. For her provisions she selects the harvest fly or cicada. You have probably heard the harvest fly when he tunes up in the latter part of summer. If you had listened closely to some of these harvest fly songs, you may have heard one start his song, and then right in the midst of it, when he was shrilling his loudest, the song stopped short. Quite likely the reason that song stopped short was that a sand hornet had driven her dagger into the harvest fly. Then comes the struggle to get that enormous insect to the sand hornet's burrow. The sand hornet of course is very strong, but also the harvest fly is very heavy. She cannot pick the harvest fly up from the ground and fly away to the burrow.

She must climb with it to a height and then fly as far as she can before falling to the ground, repeating the process until she reaches her burrow. The rest of the story is about like that of the mud dauber and jug builder.

So, you see, all of these very complicated processes of paralyzing and storing other insects is merely to provide food for the next generation of wasps, hornets, etc.

That Some Plants Eat Insects

You must not suppose that these insect-eating plants have jaws and chew their food, for they do no such thing. They do not eat in the sense that animals do. Yet, a large part of their food is made up of insects.

Now in order to eat any such lively thing as the average insect is, it is necessary first to capture it. Of course, these insect-eating plants do not chase around through the fields after the insects, with butterfly nets. No, they stay right still and wait until the insects come to them. Each one of these strange plants has some device by which it can catch insects that alight on it or come near it. Some of them actually have real traps, which spring suddenly and hold the insect. Some have little trap doors which let the insects go in the trap, but does not let them out again. Others have little wells of water in which the insects drown.

Let us look a little more closely at some of these insect-eating plants. First, let us take the pitcher plant. This plant has very queer shaped leaves, which look to us like small green pitchers—lip, bowl, handle, and all. If we look

inside each one of these little pitchers we find that down at the bottom there is a little pool of water. Now if we should tip the pitcher up so as to pour out the water in the bottom of the pitcher, we would find anywhere from two or three to dozens of different kinds of insects in all stages of decomposition. How does it happen that all these insects were drowned in that one tiny pool of water? To get at this secret we should have to understand just how the pitcher is made, and possibly look at it under a strong magnifying glass. We would find that entirely covering the inner surface of the upper part of the pitcher there are numerous stiff sharp hairs all pointing downward. Just below this area there is a surface which is perfectly smooth and very slippery. Now this is what happens when an insect is flying near the pitcher plant: He smells the odor of a liquid that is secreted from that slippery part of the inside of the pitcher. He decides to investigate. He starts to crawl into the pitcher. Perhaps he keeps on going; but if he gets "cold feet" and tries to back out, he will find a whole forest of bristling spears holding him back. Quite likely he decides that the best thing to do would be to keep on going downward. Then he comes to that slippery place, and before he knows what is happening he skids right down into the water. Now unless he is a very strong insect, he can never get out, for if he does swim to the edge of the water it is utterly impossible for him to climb up those slippery walls. After a time he finally dies. Now this pool of water is not made up entirely of water. A large part of it is strong digestive juices that are secreted by certain cells in that slippery area. These digestive juices dissolve the insect, and ultimately this dissolved insect material is absorbed through the walls of the pitcher and is used as part of the plant's food.

One of the most remarkable of the insect-eating plants is the Venus' fly trap. The leaves of this plant are round

and in pairs. Each leaf has a number of sharp spines on the inner part of the leaf. When the trap is open, these two leaves are folded outward on a sort of hinge which binds the two leaves together. Now if a fly or other insect should alight on the leaf or even touch one of the spines, the two leaves would come together quickly and pin the insect tightly with those sharp spines. After that, the process is much the same as it is in the pitcher plant, except that there is no pool of water; the digestive juices acting directly on the insect. The trap is kept closed until the insect has been entirely dissolved. Then it opens out and is ready for the next victim.

An insect-eating plant that is something like the Venus' fly trap, except that it does not work so quickly, is the sundew. This little plant has round flat leaves which lie close to the ground. Covering the upper surface of this leaf are a dozen or more stalks about a quarter of an inch long. On top of each stalk is a little knob which contains cells that secrete digestive juices. If any one of these stalks were touched it would suddenly bend over. And what is more remarkable, if one stalk is touched and starts to bend over, the others will do the same thing, much as a row of ninepins will all fall if you make the first one fall against the others. Now when an insect comes along and decides that he wants some of that sweet nectar on the sundew leaves, just as soon as he touches one of these hairs it bends over, and then all the others start to bend over. It is quite likely that the insect will get caught by at least one of his feet or by a wing. If that one stalk does not hold him, all the others come tumbling on him, much as the team of foot-ball players used to pile on the man down in the old-fashioned type of football. The poor insect has not much chance now. He is held there until he is entirely digested, just as he is in the Venus' fly trap.

There is still another interesting type of insect-eating

plant. This one is an under-water type. It is the bladderwort. This is a semi-floating plant, with most of its leaves below water, and only the flower stalks protruding above the water, looking much like the periscope of a submarine. Now the very name of this plant, the bladderwort, which literally means a "bladder plant," tells us part of the secret. All over the plant are hundreds of tiny bladders, not much larger than the head of a match. Each of these little bladders has a tiny trap door in its side. These traps are set for little creatures inhabiting the water, some of which may be insects, but most of them different kinds of tiny water organisms. These tiny organisms may swim through this trap door at any time, and enter the bladder. When this happens, the trap door immediately shuts, making the little organism a prisoner. From this time on the process is much the same as it is in the pitcher plant.

Now you may have been wondering all along why these plants eat animal matter, instead of making their plant material for themselves, or robbing it from others, as some plants do. We have not yet found out the whole secret of this matter. The scientists think, however, that the reason they capture and eat animal matter in this way is that all of these plants live in situations where there is not a sufficient amount of the nitrogen compounds, and that they supplement the food that they manufacture themselves by this nitrogenous material obtained from the insects.

Why the Milkweed Has Milk?

The milkweed plant is very well named, for as you know, whenever a leaf is broken off or the plant is bruised in any way, little drops of white fluid ooze out, and this fluid looks exactly like milk. Of course, it is not milk. You may have tried to drink some of this milk and found that it comes far from tasting like real milk.

If you have experimented with the milkweed plant, you

know that practically every part of this plant contains milk. The stem, of course, has a lot of milk, and when the leaves are torn, little milk drops leak out all along the edge of the torn leaf. Even the flower stalks give milk when they are broken off. You may have thought that this milk is merely the sap of the milkweed plant, but this is not so. It is a special secretion of the plant, just as the resin or gum is a special secretion of some evergreen trees. It is contained in special veins which run throughout the plant, and does not come out of the veins which convey the sap in the plant.

Now there is a reason for most things that we find in nature. There is probably a reason for everything, if we

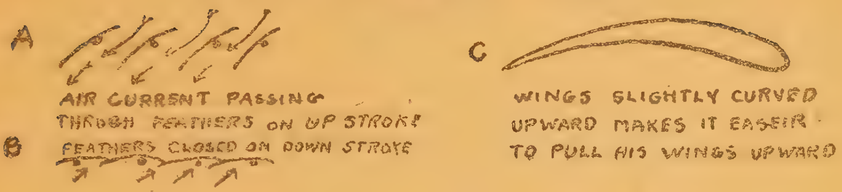
only knew it. It is easy enough to find out the reason for milkweed's milk. In fact, there are two reasons. In the first place, when you tasted the milkweed's milk, you were well on the way toward finding out one of the reasons. You may remember how acrid and distasteful this milk is when you get it into your mouth. Of course animals attempting to eat the plant find it just as distasteful (except some of the leaf-eating insects who seem to have acquired a taste for this milk and who eat the leaves, milk and all). You can readily see now that when any grazing animal comes to a milkweed plant and attempts to eat it, he gets a mouthful of this very acrid milk, and immediately stops eating. That is, he stops eating if he has never eaten a milkweed plant before; but it is quite likely that most of these grazing animals have already experienced this taste, and leave the

milkweed plant out of the daily menu. Thus the milkweed plant is protected from its most destructive enemies.

We would find out the second reason for the milkweed's milk if we should bruise any part of the milkweed, and then come the next day and examine this bruise. We would find that where we had bruised the plant there is a hard rubbery substance covering this bruise completely. This substance acts as a very effective healer of the wound made in the plant, and prevents disease germs from getting into the wound.

As I said in one of the paragraphs above, milkweed juice is much like the resinous sap of some of the evergreen trees. Yet, it is still more like the sap of the rubber tree. In fact, it is almost identical with this sap. If I were to ask you the reason why a rubber tree gives milky sap, you might say that it is so that we may have rubber to use; but this is looking at it wholly from our point of view. From the rubber plant's point of view it is for exactly the same purpose as the milkweed's sap—to heal up any wound made in the tree.

You might try some time the experiment of collecting as much of the milkweed's milk as you can get from a milkweed plant, and let it stand for a day or two, and then look at it. It will be almost like rubber. Of course it is not just like it, and it would have to be worked over considerably to make it into real rubber, but it is quite unlikely that it would be as satisfactory as the real rubber from the rubber tree.



How a Bird Flies?

Ever since man has had an ambition to fly himself—and he has had this ambition almost since the dawn of civilization—he has studied the birds in an effort to imitate their flight. Men have even constructed huge wings shaped like a bird's wings and attempted to fly with them. But he failed, for several reasons. We cannot tell all these reasons here. When you have learned just how a bird does fly, you will know some of these reasons.

If you were to examine closely the wing of a bird, you would notice that the principal feathers in the wing overlap each other regularly. If you should take one of these feathers in your fingers, you would find that it turns slightly in its socket. Now let us suppose that we are riding on the back of a bird and can watch exactly what happens while the bird is flying. We would notice first of all that when the bird lifts his wing upward suddenly, each one of the principal feathers in the wings turns slightly in its socket, and that the outer edge of each feather bends downward. It is the pressure of the air against these feathers, as the bird lifts his wing up suddenly, that turns the feathers and bends the edge downward. If we looked very closely we would be able to see that the air is now rushing down through the wing between the edges of the feathers. This, as you will see, allows the bird to lift his wing up quickly. Look at the accompanying diagram and you will see, opposite "A," just how the air gets down in between the feathers when the wing is being raised.

Now watch closely as the bird starts to bring his wing downward. No sooner does the wing start to go downward than each one of the feathers of the wing turns back again, closing up these little gaps between the feathers and making the wing solid. You see now that no air whatsoever can pass through the wing. That enables the bird to push against the air, and this, of course, tends to raise the bird upward (see "B" in the illustration).

If you know how to row a boat, you know that you can, by skillful manipulation of the oars, row steadily without taking the oar out of the water. You do this by quickly turning the oar, after you have made a stroke, so that the oar slides back through the water on its edge. Another thing that you can compare with the action of a bird's wing is a lift pump. In the lift pump there is a little valve that allows the water to go through one way and not the other. This valve is called a "check valve." You see, the water going through the valve is about the same as the air going through the feathers of a bird's wing.

Another point in the structure of the bird's wing that helps him fly is the shape of the wing. All birds' wings are curved slightly upward (see "C" in the accompanying illustration). This, as you will see, makes it easier for the bird to pull his wing upward through the air, and at the same time, when he makes a downward thrust with the wing, the air is caught in the hollow underneath the wing; and this, of course, helps him to rise upward.

There are many other things that help him in his flight. For one thing, he is constructed on the "stream-line principle," so that he offers as little resistance to the air as possible in flying through it. Another thing is that his bones are all hollow. This gives the greatest amount of strength for the weight. Hollow bones are, of course, lighter than solid bones; yet they are just as strong.

Do You Know?

Why Dogs Bury Bones?

When you give your dog a perfectly good bone with fresh meat on it and expect him to sit down and enjoy his meal, it is quite likely that instead of eating it up at once, he will go off and bury the bone somewhere in the ground. If you do not let your dog out of the house, he may even try to bury it under the rug. When he does this, you are probably rather provoked with him. At least you are puzzled and probably wondered just why he wanted to bury it instead of eat it.

To get at the reason for this habit of burying bones and other food that our dogs have, we must go back to the early history of the dog for an explanation, just as we have to do this to find out why a dog barks at the moon, for example. In the far-off days when all dogs were wild, and had wolf-like habits, no dog knew from one day to the next whether or not he was going to have a good square meal. Some day he might not be able to get anything to eat. It all depended on the success of his hunting. Now it is quite natural among these wild dogs that when they had made a killing of a large animal, and had eaten their fill, they would want to save the rest of the food for some future time when they were hungry again. So the wild dog used to look around for a good place to hide it, and the best place of course was in the ground, where it would not be easily found by other meat-eating animals, or by other wild dogs.

You must think of your dog as an animal who has not been entirely civilized. That is, there are certain traits, which he has inherited from his far-off ancestors, and to which he still clings. Of course, your dog does not know that he was following out these ancestral traits.

Who the First Paper Makers Were?

The first paper makers were not people at all, but insects. When we read about the making of paper by ancient Egyptians, or by other people in Europe, it seems like a very long time ago to us when they first started to do this. But the insect paper makers were making paper for no one knows how many thousands of years before the first human paper maker began to make it. These insect paper makers are, as you may have guessed, the paper wasps.

In order to find out just how the paper maker makes his paper, let us imagine that we are invisible, so that we will not frighten our paper maker, and small enough so that we can follow him about wherever he goes. For the first step in the process, we would see the paper wasp on an old fence post, or on a dead tree trunk which was partly decayed. We would see him tearing off little shreds of the partially decayed wood until he had as much in his mouth as he could hold. Then we would see him busily chewing up this ma-

terial with his queer set of double jaws, one working up and down and the other working sidewise. After a minute or two of this sort of chewing he would fly away. Let us follow him now. There he is on the unfinished paper nest. We would see him go to the outer edge of this nest, or to the edge of one of the cells or chambers, and carefully place this chewed-up material on the edge. As he worked, you would see the edge grow outward. After a few moments he flies away again and repeats the process.

When our wasp went through his chewing motions on this woody material, he was reducing it to a pulp, something like the wood pulp that all paper has to pass through in the course of being made from wood into the paper that we know. But there is one part of this process which is quite different from our process in making paper. After the wasp chews up his wood pulp, little streams of sticky saliva are secreted from his mouth, and mix with the wood pulp. This helps to bind the pulp together. The sticky substance that the wasp mixes with his wood pulp is waterproof; so when the paper is finally made into sheets and attached to the nest, it is ready to stand the hardest rains of the summer.

How a Snail Walks with Only One Foot?

A snail really doesn't have a foot, in the sense of feet as we know them. It doesn't hop. In fact, it doesn't even take its foot from the ground as it walks. How, then, can it walk at all, if it does not take its foot from the ground?

To get at the secret of the way a snail walks, we must find a snail, put him on a piece of glass, and watch him walk from the underneath side of the glass. We would then see a very interesting thing. Probably the first thing that we would notice would be a series of waves going along

the foot from the back to the front. These waves are made by the action of the muscles in the foot, and are almost like real waves. That is, the muscular motion starts in the back of the foot and progresses towards the front of the foot. When it comes to the front of the foot, the portion in the immediate part of the front of the foot goes forward slightly. At the same time the back of the foot goes forward slightly. As each wave reaches the front of the foot, there is another slight forward motion. This forward motion continues, and has the effect of making the snail sort of slide forward on its foot.

Thre is one more interesting thing about the snail's walking. As the snail slides forward, he secretes a gluey substance out of little pores all through the bottom of the foot. This gluey substance helps him to get a foothold on any slippery object that he may be walking on. That is the reason why he can walk on glass, or can walk up the side of a smooth rock or plant stem.

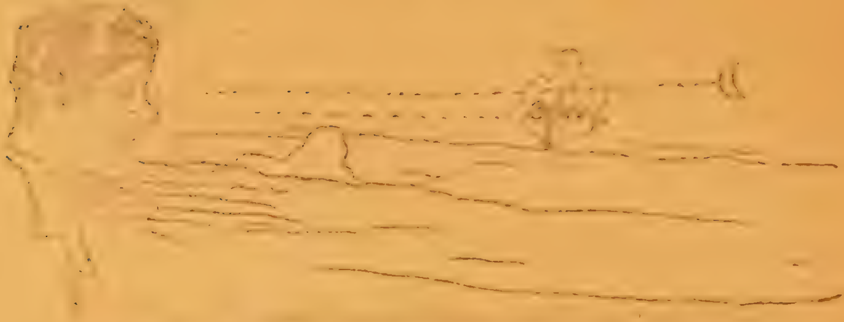
What Toad's Warts Are For?

You have probably heard all sorts of stories about toads' warts, and toads in general. You may have heard that the reason that toads' eyes are so bright is that they have jewels in them. At any rate you have probably heard that if you handle a toad you will get warts. All of these things

are of course not true. If you took a toad apart you could find no jewels whatsoever, and you can handle a toad all day long without getting warts from him.

In finding out what toads' warts are for, the first thing to understand is that there are two different sets of warts on a toad. Up near his neck there are two very large warts, one on either side. These warts are for the toad's protection against his enemies. They contain a set of glands which secrete a very distasteful fluid, which is even poisonous to some animals if they get that fluid in their mouths. You may have watched a dog attempt to capture a toad. If you have, you undoubtedly noticed that the minute your dog started to take the toad in his mouth he dropped it immediately and commenced to shake his head violently. Probably you noticed also that the dog frothed at the mouth. Perhaps you got a little frightened and commenced to be afraid that your dog was going mad. However, this is far from the case. It was merely the poisonous secretion from the large warts near the toad's head that caused all this trouble. You can readily see how this protects the toads from their enemies. Of course there are some animals that have become used to this poisonous secretion.

It is not quite so easy to find out exactly what the other warts on the toads are for. It is thought by some scientists, however, that they are something in the nature of storage tanks for water, similar to the humps on a camel, which you probably know are for the storage of water while the camel is traveling over long distances in a waterless desert. Now, of course, the toad does not live in a desert. He does live in rather dry places, however, and he needs much water to keep him going. It is thought, therefore, that these warts are for the purpose of storing moisture, so that if a toad is not able to get to a place where he can soak himself full of water, he can draw on this reserve supply of moisture in his warts.



Why We See Some Things Happen Before We Hear Sounds from Them?

[illegible] you have been looking off from a high [illegible] where you could see [illegible] what seemed a long time afterward.

Now both the sound from the whistle or the [illegible] ... much [illegible] ... a mile away, on the earth. Now let us suppose that these two trains [illegible] of the train on the earth. [illegible] from the moon train would not reach us for [illegible].

What the Difference Is Between a Plant and an Animal?

At first thought this might seem to you as a very easy question to answer. It is easy enough for you to tell an ordinary animal from an ordinary plant, and if you were asked to say just what the difference is between a plant and an animal, you would probably reply that an animal can move about, and a plant cannot.

Your definition of the difference between a plant and an animal is all right so far as the majority of plants and animals are concerned. But what are you going to say when I tell you that there are some plants that can move about freely, and other animals that cannot move at all. For example, there is the tiny diatom that lives by the millions in water that is not running too swiftly. The diatoms are different shapes, but most of them look like tiny submarines (they are so tiny that you cannot see them unless you look at them under a microscope). Let us suppose that you are watching a diatom under a microscope. You would see it move forward very slowly, then stop and go backward. Yet the scientists have proven that this little diatom is really a plant, because it has green coloring matter and can manufacture its own food.

For an example of an animal that cannot move, let us take the sponge. A sponge, when it is alive, is just as much an animal as your dog or cat, although of course it is nowhere near being so complicated. It is securely fastened

to the bottom of the ocean, and lives by making little currents of water which draw in food materials which it strains out, much as the whale strains out his food material.

Now of course, both the diatom and the sponge are very low in the scale of plants and animals. The farther down we go the more nearly like each other plants and animals become, until we get to a place where it is hard even for the scientists to decide whether the organism is a plant or an animal.

There is one principal distinction, however, by which we can usually separate plants from animals. That is the method of getting food. Practically all the plants manufacture their own food from the raw materials of the air and of the earth. On the other hand, animals cannot manufacture food for themselves. They must get it by eating either plants or other animals. Of course, there are exceptions to this. The mushrooms do not manufacture their own food, but they are very definitely constructed like a plant, and in every other way except the getting of their food they are like the other plants.

Why Most Plants Are Green?

You have of course noticed that practically every plant is green. There are some exceptions, but the majority are some shade of green. That is, the leaves at least are always green, and sometimes the whole plant is green. Probably you have heard somewhere that the reason leaves are green is that green is the most restful color to our eyes. This of course explains it from our point of view, but it does not

explain it from the plant's point of view. Plants and animals do not do things just for our benefit. Usually everything that they do is very important for their own welfare.

If you should take any part of a green plant and look at a very small portion of it under a high-powered microscope, you would see that most of the cells are packed with tiny round green bodies. There are millions of these little green bodies in a tiny bit of leaf, for example. These little round green bodies are called chloroplasts, and the green coloring matter inside them is called chlorophyll.

It is this chlorophyll that gives the green color to practically all our leaves and to the stems of many of our plants. Now you will probably want to know why there is so much of this chlorophyll in plants. Chlorophyll is the most vital substance in green plants. It is the substance that enables the plant to manufacture its own food. Through the action of sunlight, this green substance can convert the new materials of the air and the earth into starch, sugar, and the various other materials with which the plant builds its parts.

Now let us turn to those plants which have no green coloring matter in them whatsoever. The mushrooms are a good example. Why is it that they are not green but are white, red, yellow, or almost any other color except green? The secret of this is that the mushrooms have learned to get their food by using food materials in the soil which have already been manufactured by other plants or by animals. They do not need chlorophyll, you see, because they do not manufacture any food for themselves.

That Insects Have "Soda Fountains"?

Most of Mother Nature's insect children are like human children in one way at least. They like sweets. From the tiniest fly up to the largest night-flying moth, you will find that most of them will never refuse a sweet sip if they can get it.

Some of the insect children live entirely on sweets. Now, much as you like candy and jelly and all the other good things that are mostly made of sugar, you wouldn't want to live on those things, would you? But take the moth children and butterfly children, for example. Their mouths are made so that they cannot eat anything solid. In fact, they have no mouths at all; or rather, they have nothing that you would call a mouth. Instead, they have a long tube that they use to suck in their food—just as you use a straw to suck in your soda. The grownup bee children have the same sort of tube, only it is much shorter.

Now you know that when you see any of the butterfly or bee children working on a cluster of flowers in summer that they are sipping nectar from the flowers. That is easy enough to understand. But there are no flowers in March—at least not many flowers. Yet during the warm part of a bright March day you may see the bees flying about, and here and there you will see a butterfly. Where do they go to get their sweets? They certainly cannot go into the

drug store and tell the clerk to give them a vanilla soda "and put lots of sugar in it"!

As a matter of fact the bee children and butterfly children have soda fountains of their own in the early spring. No, not the kind where the clerk has to turn a handle and let the soda run into a glass! The fountains of the bees and the butterflies are running all the time, and all they have to do is to go up to them and drink as much as they wish, without paying a penny for their sweets. Maple flavor is served at one, birch at another and so on. The insect children "take their pick." If one fountain does not serve its "soda" sweet enough for them, or if it is not the right flavor, they go to another.

These "soda fountains" that Mother Nature has provided for her early-rising butterfly and bee children are on the trunks or branches of the trees, or on top of a stump that was cut down last year and so is not yet dead. You know that one of the first things that happens just before the trees wake up in the spring, is that great quantities of sap commence to flow up into their twig-fingers and down into their root-toes. There is so much of it that, wherever the tree is cut or bruised, it flows out and oozes down the sides of the trunk. When that happens, a free "fountain" is started up for all the bee and butterfly children who care to call.

You know of course that maple syrup is made of maple sap. The sap is not so sweet as the syrup, for it has much more water in it. Still, it is sweet enough for the insect children. But you may not know this: the sap of all trees has some sugar in it. Some trees have more than others. The maple has most of all. But each tree has a little. You may wonder who put the sugar in this tree sap. If you had cut into the tree late in the fall or in the winter you would find no sugar. And certainly the ground is not so full of

sugar that the roots can suck it up in spring. No, the secret is this: Mother Nature has taught all her trees how to turn the sugar in their sap into starch each fall and store it away in this way until spring. When spring comes, they turn it back into sugar and this sugar mixes with the sap and makes it sweet.

Of course, even in March there are some flowers that the bee and butterfly children can visit. But they all like to go to the tree fountains now and then—especially the butterflies. The next time you go out into the woods in spring, see if you can find one of Mother Nature's tree fountains.

That the Sun Makes Everything Go?

You don't believe that, do you? Well, it does seem rather hard to believe. The trouble is, you have never seen the sun make anything go; that is what fools you. It is only indirectly that the sun makes things go. But, indirectly, there is nothing "under the sun" you can think of that could go at all if it were not for the sun.

The best way to find out just how the sun makes things go is to ask yourself what causes things to go. But you can't stop right there with the immediate cause; you have got to keep on going until you can't go any farther. And you will always find that in the end you will come out at the sun.

Let us take first something that is easy. You have probably seen a waterfall, or at least you have seen a picture of one. What makes the water plunge over the fall and go

dashing down the ravine below? "Why, gravity," you say. Yes, that is the immediate cause, but gravity could not have pulled the water over the falls and down the ravine if the water had never been up above the falls; and it was the sun that put the water there! The sun evaporated the water from the rivers, oceans, and lakes, and the warm air, heated by the sun, carried this evaporated water up where it formed into clouds. The water finally came down as rain, and filled the stream above the waterfall. It was the sun's energy, you see, that put the water up where it would go down over the falls.

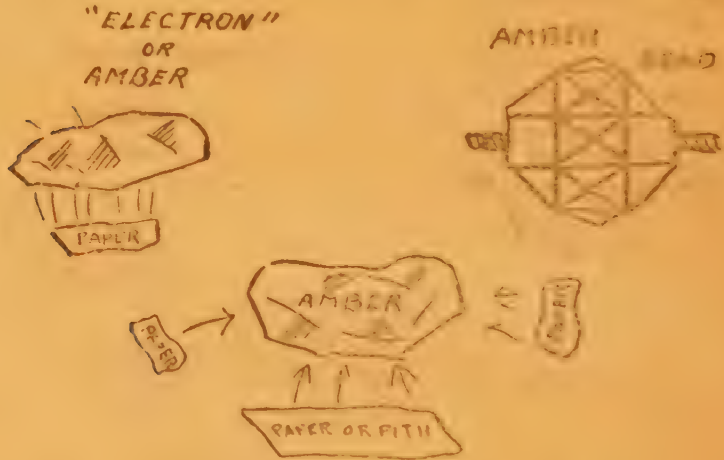
When you ride in an automobile, a train, or a trolley car, it is really the sun that furnishes the energy to make these things go. The gasoline that runs the automobile engine comes from plants and animals that grew millions of years ago. The coal that burns in the firebox of the locomotive is nothing more than the remains of plants and trees that also grew millions of years ago. And of course it was the sun that made these plants grow in each case. The electricity that makes the trolley car go was made by dynamos, which in turn were run by either a steam engine or a water-power turbine. If it was a steam engine, coal made it go; if it was a water turbine that furnished the power—well, you already know how the sun makes the waterfall that turns a water turbine.

I think that by this time you will be able to see how it is possible for the sun to make things go. In every case, you will find that in the first place the sun furnished the energy. Sometimes it is only a few hours before this energy is released and made to run things, or it may be millions of years before it is released. Probably it has never occurred to you when you are riding along a mile a minute on an express train that it is really the sunshine shining in a strange world of steaming swamps more than fifty millions of years ago that is carrying you along so fast on that train!

How Electricity Got Its Name?

It is only during the last hundred years that much has been done with electricity. And until [illegible] years ago almost the only thing that was known about it was that it had something to do with magnetism and that it could be produced by rubbing amber. Even as far back as 2000 years ago Roman philosophers knew that when amber was rubbed it attracted light things like pith or pieces of paper.

Now when the scientists began to experiment with magnets and with amber to learn what caused these things to



act the way they do, they decided that some strange power must have caused them to act that way. Not knowing just what to call this power they gave it a name that was taken from the Greek word meaning amber. The Greek word was "electron," and the term first used to describe electricity was "electrica." After some years the term was changed to "electricity," but the adjective has always been "electrical."

How Long We Have Used Safety Pins?

If you have ever thought about it, perhaps you have wondered who invented the useful safety pin, and if the inventor became wealthy from his invention. Perhaps some inventor has become wealthy through patenting some better way to make safety pins or through some little improvement on them, just as the man who patented the kinks in a hair pin became wealthy. But the safety pin itself; in fact, the very same model that we use mostly, was made long before there were any patent laws.

To go back to the very first safety pin would carry you back very much further than you can easily imagine, for it goes back to the period of civilization in Europe called the Bronze Age. The Bronze Age is not a definite historical period like the Middle Ages, but is a period in which civil-

ization had advanced in certain regions to the stage where men had learned how to make weapons and other implements of bronze. The period of civilization before the Bronze Age is called the Stone Age, because implements and weapons were made of stone; and the period following the Bronze Age is called the Iron Age, because men had learned how to make things of iron.

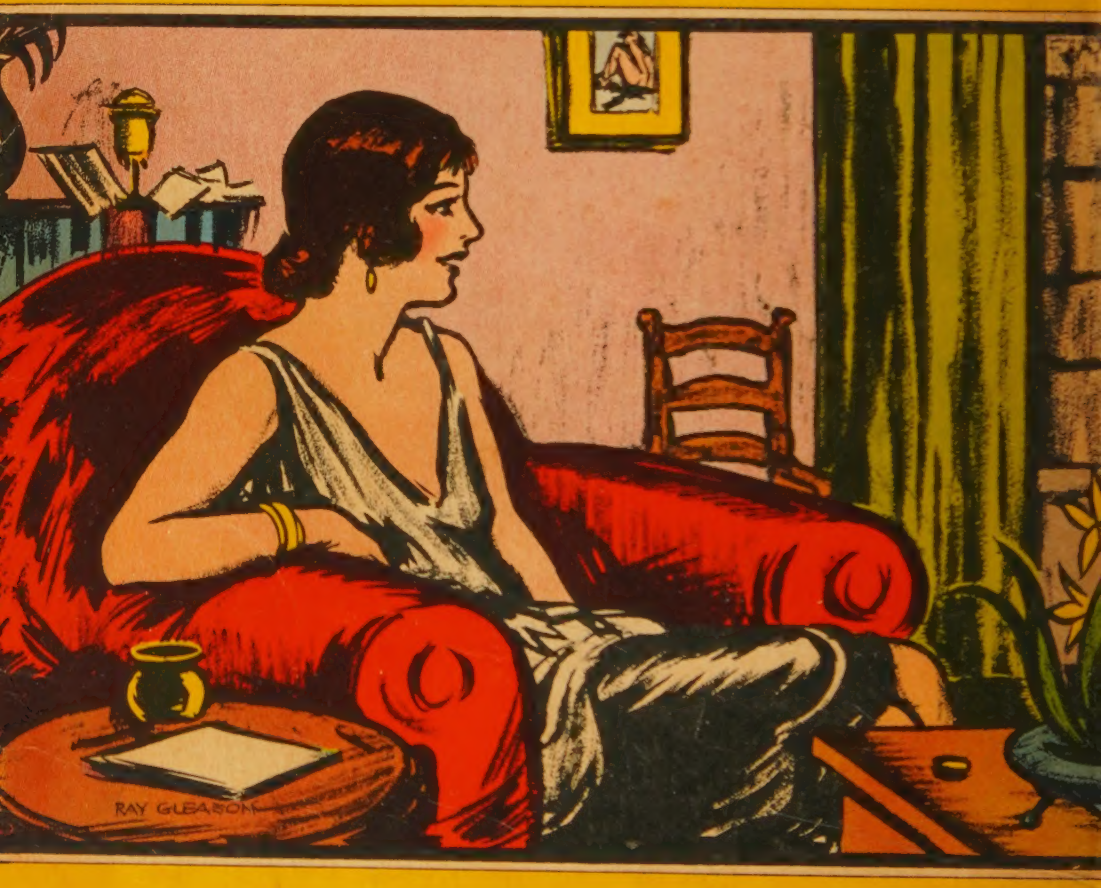
It was in central Europe, while the people there were living in the latter part of the Bronze Age, long after they had learned how to weave threads into cloth, that the safety pin was invented. This was probably about 3500 years ago. If you could go to one of the museums where such relics are kept, you would see a collection of safety pins made in the Bronze Age very much like those of today.

Why the Hour Is Divided Into Sixty Minutes?

To find out why the hour was divided into sixty minutes instead of into fifty or a hundred, we must go back for perhaps five thousand years, to the time when the Chaldeans lived in Babylonia.

We do not know so much about the Chaldeans as we do about the ancient Egyptians, for example, but they did leave records of some things they did, which have come down to us through their practice of carving on clay tablets. We find by reading these blocks that at that time they had a system of counting by 12's and 60's instead of by 10's and 100's, as we do now. It was they who first divided the hour; and as they counted by 60's it was of course natural for them to divide the hour up into sixty minutes. In the same way they divided the minute up into sixty seconds. Their system of counting by 12's instead of 10's accounts for the division of the day into twenty-four hours, which is of course two twelves. That is the reason that we stop at twelve o'clock and start again with one o'clock instead of stopping at ten o'clock and then starting again at one. If we were doing the job of dividing up the day, we should probably divide it into twenty hours and then divide it again into two parts, each containing ten hours. We should also probably divide the hour into one hundred minutes ana the minute into one hundred seconds.

The next time you look at your watch or at a clock, you must think of this division of the day into two parts of twelve hours each, the hour into sixty minutes, and the minute into sixty seconds, as going back almost to the dawn of civilization. This is only one of the numerous habits and customs which we take for granted, but which were really established thousands of years ago.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